Midwest Engineer

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MANAGEMENT AND ENGINEERING—PAGE THREE
WSE MEETINGS—PAGE TWO

Vol. 6 APRIL, 1954 No. 11

they're off!

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CONTENTS

Management and Engineering 3
At the Washington Award Dinner 6
Man's Building Ability 9
Model Railroading 11
Applications 20
Crerar Library News 22
Letters from Leaders 23
ESPS Listings 24
Professional Cards 26
Book Reviews 28
Obituaries 29
Personals 30
Advertisers' Index 32

COVER STORY

Dr. Lillian Moller Gilbreth, the 1954 recipient of the Washington Award, appears on our cover this issue. She is the president of Gilbreth, Inc., consulting management engineers of Montclair, N. J. Dr. Gilbreth is a world-famous engineer, authoress, educator, humanitarian, lecturer, and counselor. She is best known as the central figure in the book, "Cheaper by the Dozen." See pages 3 and 6 for more details.

May 7, Ladies' Night Party

Speaker: Walther Buchen, president of The Buchen Co.

Subject: "Collecting and Hunting in Africa." This will be an evening to remember! The Social hour will be at 5:30; Dinner at 6:45; the Program at 8:00; and to crown the festivities, Dancing at 9:00.

The place? At WSE Headquarters.

May 12, Noon Luncheon Meeting

Speaker: Admiral Francis P. Old, U. S. Navy (Ret.), now executive director of the Illinois Toll Highway Commission.

Subject: "With the Battleship *Indiana*." Admiral Old was commander of this great fighting ship for some time during World War II. He will relate some of the interesting experiences which he went through.

May 18, Mechanical Engineering Section

Speaker: Walter B. Bergstrom, an engineer with Babcock & Wilcox Co.

Subject: "New Developments in Power Generation." Power generation is one of the primary factors in America's strength. Want to hear the latest on it? You will, and also see the interesting 40-minute movie, "Steam for Power," which will illustrate the talk.

May 19, Noon Luncheon Meeting

Speaker: C. O. Ellis, general superintendent of communications of the Rock Island railroad, and chairman of the Communications Section of the Association of American Railroads.

Subject: "Modern Railroad Communication Facilities." Listen to some intriguing facts—have a pleasant meal.

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Management and Engineering

By Dr. Lillian Moller Gilbreth

Some 50 years ago, when interest in management began in the United States of America, it was called Scientific Management. This was especially fortunate in that it put emphasis on the scientific aspects of management and established an affiliation with engineering that has never been lost.

The job of the engineer, has been defined as "utilizing the resources of nature—and of human nature—for the benefit of mankind." It is obvious that engineering has always utilized the resources of nature. The engineers in the field of management have for over half a century also emphasized the importance of utilizing the resources of human nature, and to the benefit of all fields of engineering.

All of the pioneers in Scientific Management were engineers. They received their academic training in different schools and colleges. They supplemented this by membership in various engineering societies. All were members of the American Society of Mechanical Engineers, which was a reason for the establishment of a Management Section of the American Society of Mechanical Engineers, but which may also be the reason that the other "Founder Societies" have not developed Management Sections as yet.

All these pioneers cooperated in starting "10 year Progress Reports" in A.S.M.E. which continue to this day. All cooperated in Public Service, like presenting under the leadership of Louis Brandeis, to the Interstate Commerce Commissions case material on the usefullness of Scientific Management in reducing costs. All contributed to education, when and as they could, as evidenced by the Report of the Amos Tuck School Conference, held at Dartmouth College in 1911. All met the challenge of the war by offering their resources to the government as a group—for example, through The Society of Industrial Engineers, with headquarters in Chicago (now a part of the history of the Society for the Advancement of Management, which resulted from the union of the Society of Industrial Engineers and the Taylor Society.)

All who were alive in 1924, plus those who had followed the pioneers, attended or endorsed and contributed to the first International Management Congress, held in Prague. From this developed C.I.O.S., the International Committee of Scientific Management, which held its 10th International Management Congress in Sao Paulo, Brazil, in February of this year, with a membership of 24 countries.

The titles of the books and papers of many of the pioneers indicated their scope of interest and the preponderance of engineering topics.

It should perhaps be pointed out that the titles emphasize both the "technical" and the "human" side. They also point to avenues of development, not only in engineering, but in economics, psychology, physiology and sociology.

On the technical side, we have as typical, the stop watch method of taking times and the slide rule developed by Barth, as used by Taylor; the slide rule and the schedule planning chart, as developed by Gantt, the Process Chart, Micromotion technique, Simo Chart and Chronocyclegraph as originated and developed by Gilbreth. On the "human" side we have studies in work conditions: motivation (non-financial as well as financial incentives): group and team work: adaptations to meet the needs of individuals and of groups like the physically disabled: emphasis on effective learning and teaching.

The method used, in Management, follows that used in engineering. It is the scientific method, The engineer must: 1) find his problem, 2) state his problem, 3) face his problem objectively, 4) utilize his resources to solve it, 5) state and share his results as simply, clearly, promptly and widely as he can.

Kipling, "the engineer's poet" has put this technique into words for us, in "The Serving Man." He says:

"I keep six honest serving men
(They taught me all I knew)
Their names are What and Why and When
And How and Where and Who."

Note that the questions are " honest," that they "serve," that they "teach," and that the learner learns, as must be the case, if the teacher really teaches.

Today we usually start with Why? go to What? Who? Where? When? How? Note also that this questioning attitude is not the Socratic one, which aims to show the questioned how ignorant he is, nor is it the legal, either that of the lawyer for the defense or for the prosecution. It is the attitude of the intellectually curious, who listens carefully to the answers to his question. The scientist has established the methods of pure research, and applied research. The engineer follows these. So does the Management man.

The questions concerning the human element may seem to include only the "Who." As a matter of fact every question includes the human element. The "What" is to be done, resulting in job descriptions, develops into job requirements or job demands—physical, mental, emotional, social.

The "Why" is more likely than not to involve human relations. The "Where" is influenced by human requirements and develops into the most effective work place, from the standpoint of the worker on the job. The "When" must consider "time how long" before the "time when," schedule is made. This includes study of worker pace as well as machine speed and demands. The "How" has increasingly put emphasis on the worker, in developing the work method.

The scope of the Management field has increased with the years. From its beginnings, Management realized that

Dr. Gilbreth gave this address on April 7, 1954 in Chicago after having been presented with The Washington Award for 1954, "an honor conferred upon an engineer by fellow-engineers for accomplishments which pre-eminently promote the happiness, comfort and well-being of humanity." She is president of Gilbreth, Inc., Montclair, N. J.

this field included all work, activity, productivity. The pioneers made the first applications of Management principles in industry in construction work (civil engineering) and in the factory (mechanical engineering.)

Then came the applications to business, starting with the office. Then came applications to agriculture (the farm); home economics (institutional management and the home), the library, the hospital, (especially surgery and nursing), the problems of the physically handicapped, sports, etc. The books, papers, films, case material of the past 40 years record these applications.

As for geographical expansion, the local, regional, national and international publications carry the research in this field. Especially valuable are the publications of the 10 Congresses of C.I.O.S. and of the Secretariat, under a series of devoted directors, supplemented by valuable executive committees.

Management has created challenging responsibilities and opportunities for engineers. It created the Industrial Engineer, who is now not only a recognized member of the engineering profession, and an accepted member of the various management groups, but who has now his own academic degree, his own professional society, (American Institute of Industrial Engineers) and is busied about securing a professional license based on examinations and criteria in his field of work. It is hoped the industrial engineer will apply for membership through his technical institute in the Council for International Progress in Management of the U.S.A. and then become a member of C.I.O.S.

Many new branches of established disciplines will have developed because of management's needs to use these disciplines as resources. The industrial physician, the industrial nurse, the industrial physiologist, skilled in body mechanics (the name preferred by engineering is bio-mechanics,) the industrial psychologist, the industrial psychiatrist all are accepted members of their professions who have added to their training a knowledge of, and often an internship, in industry. We expect, soon, industrial sociologists, etc.

It is obvious that these people bring with them not only their appropriate techniques but also large contributions to the human side of management. The term "human engineering" has sometimes been applied to their work, or to those who use their findings. This has, by and large, not been an acceptable term to engineers. While recognizing the compliment (real or implied) paid to the scientific method of engineering, it has been felt that the application of this method requires the disciplined training of the engineer. Therefore, while the engineer could approximately use the term, as covering part of his work ("utilizing the resources of human nature") it could not appropriately be used to cover completely the work of management engineers. Also, of course, such work is done by *all* engineers, not only by those in the management field.

In spite of this, the term "human engineering" seems to be coming into wider and wider public use. It is even found in some curricula. The affiliated groups mentioned have contributed much to management. Techniques of personnel work have proved useful; tests and measurement (physical, mental, emotional, social); techniques of the interview; of labor relations (built, many of them, on Mary Follett's pioneer contributions.) Also technique of participation, as evidenced for example, by films, which must pass two criteria. Are they of *real* workers on *real* jobs? Do they evidence worker participation?

Also, the newly developed art of communication, which not only releases the desire to communicate, but teaches how this can be done effectively.

Management cannot claim the credit for the results of the work of these affiliated groups. It *can* claim that the questions it has asked have had an effect on producing the answers, or guided attempts to find them. Questions on fatigue, the work of the physiologist. Questions on effective use of the body—the work of the body mechanics and physical education people. Questions on recruiting, selecting training and utilizing of people—the work of the industrial and of the clinical psychologist, and of the psychiatrist.

Education for management is closely related to engineering education, in that most of the management men in the industrial field have had their undergraduate and graduate education and training in engineering schools, colleges and universities. Many people now doing management work today have prepared in Business Administration, Economics, Psychology or Commerce. And of course those working in agriculture and in home economics have usually done the major part of their training in those fields, electing management as a minor. A few people have both engineering and psychological preparation — well bal-

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anced and integrated. Fewer still, have home economics and industrial engineering, or agriculture and industrial engineering.

As for courses in industrial engineering, these are increasingly available everywhere. Undergraduate students in many places spend part time in industry. Workers in industry spend part time in school, some on company time, some on their own time. Each year brings more "In Service" training, made available to all industrial or business personnel from top management, through middle management, through superintendent and foreman, to the worker. Such training may be given at the factory or, office, or in any other place, thought suitable, and for any length of time, consecutive or interrupted by return to the plant or office, and applications of what has been learned. Students are almost always required or advised to bring work projects with them.

Libraries are becoming increasingly more important in what are called Adult Education programs. As librarians have taken management training from the T.W.I. (Training within Industry) courses to Industrial Management, along with industrial and business people, they have applied what they learned to Library work. This has resulted in greater efficiency of library service, and also in releasing the time and energy of the librarian for the use of higher skills. Preparing Bibliographies for use in Industry and Business; giving reader advice—sitting in on planning of management courses, to contribute material on library resources and to help have books, etc. at hand where needed, have proven enormously useful. As a result of such work, librarians may well recommend appropriate books to be included in the libraries of business and industry, as well as train special librarians for management work, as they now do for specific scientific assignments to colleges, technical schools and progressive industries.

Engineering and management societies, associations and institutes contribute to education and training. This is done through their libraries, programs, publications, but also by promoting courses for individuals or groups. Such are the courses to help engineers to get licenses, if they need "refreshers" before taking the examinations. Even young industrial engineers may not have had the preparation necessary to pass some of the examinations conducted by some states. There is talk of revision of such examinations to more adequately test the competence in the work to be undertaken and the responsibility to be assumed. It is to be hoped too, that as a license from any state comes to be honored by all the others, management may be recognized as an accepted field for the engineer. This may be adding to, rather than subtracting, from the fields of engineering to be covered by the questions.

Engineering has helped management in another and most interesting way, that is by participating in sponsoring or even helping to launch National and International Management Associations.

In the U.S.A. four of the management associations have been a part of national and international activities since the start. The American Society of Mechanical Engineers (Management Section,) the Association of Consulting Management Engineers, the Society for the Advancement of Management, have definite engineering histories. The American Management Association has had engineers on its Board and among its officers, as well as represented in its membership always. The Wallace Clark award for outstanding contributions in the field of international management, while given by the National Management Council, now called C.I.P.M., is sponsored by A.M.A., S.A.M., A.S.M.E. and A.C.M.E.

In a six month's trip to the Orient and to Australia, I found the engineering societies most helpful, not only in sponsoring meetings, but in furthering the organization of National Management Associations in their countries.

U.T.O.P. — United Technical Organization of the Philippines, brought its great influence to support a National Management Council of the Philippines. P.A.M.E.E.—the Philippine Association of Mechanical and Electrical Engineers, presented the plans and possibilities to its large and influential membership.

In Australia the Constituent Divisions of the Federal Council of the Australian Institute of Management welcomed an overseas colleague to council meetings and sponsored public meetings. In Formosa the Chinese Institute of Engineering sponsored meetings to review possibilities of a National Management Council of China and better utilization of Chinese engineers in helping the universities and colleges to teach management and furnish openings for graduates of management courses, and for faculty to work in industry during vacations or part time, during term time. Engineers, also expressed a willingness to give lectures to or to arrange plant visitations for students, if asked to do so.

In India, the fine Institute of Science at Bangalore, not only houses adequate investigations in the exact and the social sciences, but furnished ideal facilities and hospitality for a five-day conference on Management.

In Brazil at the International Management Congress, the representatives of 24 member countries exchanged experiences and planned to welcome new National Management Councils as they prepared for and applied for admission to C.I.O.S.

There remains the need to emphasize the final phrase of the definition of the engineer—and also of the management man—the work is to be done "for the benefit of mankind." It is appropriate that this point should be discussed at a meeting sponsored by the Western Society of Engineers. This Society has emphasized "helpfulness" from its foundation. The Society of Women Engineers had special cause to appreciate this generosity, when the Western Society of Engineers offered its rooms as a meeting place for the Society of Women Engineers and thus made possible adequate and enjoyable participation in the 1952 Centennial Celebration of the American Society of Civil Engineers.

It is not easy in these troubled times, to decide what is "for the benefit of mankind" in the long run, or even in the short run. What is "constructive" and what is "destructive?"

How can productivity be increased, without increasing unemployment? How can we maintain and develop research, yet keep applications and maintenance of its results in step with the research? How can we develop the exact and social sciences adequately and in equal proportion? How can we put the tremendous resource of automotion to constructive use?

(Continued on Page 14)

At the Washington Award Dinner

One of the most distinguished gatherings of engineering "brains" ever assembled in the Midwest was on hand April 7 to honor a world-famous woman engineer.

Over 500 men and women, representing every engineering field, attended the annual Washington Award dinner, honoring Dr. Lillian Gilbreth, president of Gilbreth, Inc., consulting management engineers of Montclair, N. J. Dr. Gilbreth is an eminent engineer, authoress, educator, humanitarian, lecturer and counselor.

The Washington Award was founded in 1916 by John Watson Alvord, eminent civil engineer. Dr. Gilbreth is the first woman ever to win the Award, annually conferred upon an engineer by "fellow-engineers for accomplishments which pre-eminently promote the happiness, comfort and well-being of humanity." Herbert Hoover won the first award in 1919. Other winners include Mr. Alvord, Orville Wright, Charles F. Kettering, Frank B. Jewett, Ralph Budd, Henry Ford, Vannevar Bush, Wilfred Sykes, and Dr. Gustav Egloff.

Dr. Gilbreth, who has authored scores of books and articles and holds many honorary degrees, spoke after the presentation, on "Management and Engineering." It is published on page 3 of this magazine. She was the central character in the famous story, *Cheaper by the Dozen*, written by her daughter.

Seated at the speaker's table were Dr. Gilbreth; Charles E. DeLeuw, president of the Western Society and president of DeLeuw, Cather & Co.; and L. K. Sillcox, national president of ASME and vice chairman of the Board, The New York Air Brake Co.

Also at the speaker's table were Dr. Gustav Egloff, the 1953 recipient of the award, and director of research, Universal Oil Products Co.; Ralph Budd, the 1941 recipient, and chairman of the Chicago Transit Authority; E. Montford Fucik, president of the Illinois section of ASCE and executive vice-president of Harza Engineering Co.; A. A. Potter, the 1943 recipient, dean emeritus of engineering, Purdue University; Leo F. Reinartz, national president of AIME and vice-president of Armco Steel Corp.; Titus G. LeClair, past-president of AIEE and assistant to the vice president of Commonwealth Edison Co.; and Robert H. Bacon, dinner chairman and president of R. H. Bacon & Co.

The dinner chairman, Mr. Bacon, opened the program and introduced the members of the commission who were present. He gave the commission's report and introduced

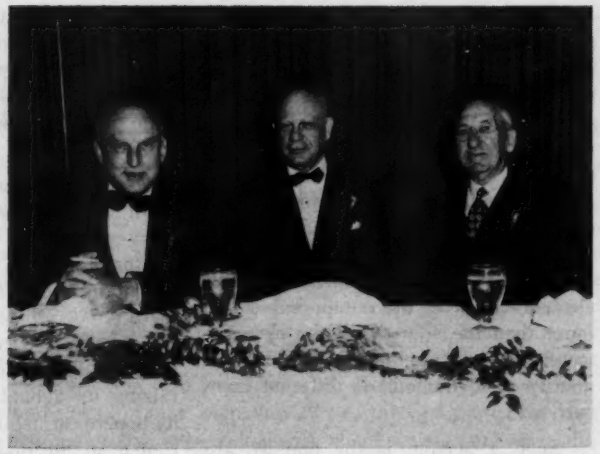
Above: Dr. Gilbreth receives the Washington Award plaque from Charles E. DeLeuw, president of the Western Society of Engineers.

the former recipients of the award who were present. He then introduced the representatives of the participating societies. L. K. Sillcox then responded for all of the societies, concurring in the selection of Dr. Gilbreth in the following words:

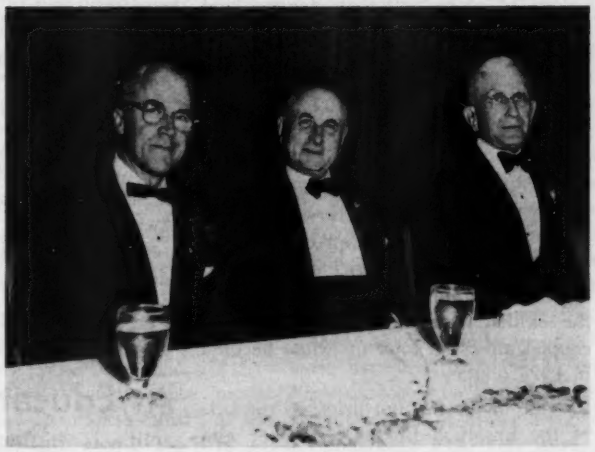
"Mr. Chairman, speaking for the representatives of the participating societies, I should like to express their concurrence in the selection by the Commission of this most distinguished engineer.

"All important cultures have ingenuities of their own. They are marvelous manifestations of the power of the mind. But our own culture—Western civilization—is the most intellectual of all. More than all others, it is the product of systematic thought. The whole world uses its inventions. Its scientific techniques, its cult of literacy, have been adopted by other nations and are transforming them.

Below: Dr. Gilbreth (on left); and Robert H. Bacon, dinner chairman.



Above, from left to right: Charles E. DeLeuw; Leo F. Reinertz, national president of AIME; and Ralph Budd, the 1941 recipient of the Award.



Above, from left to right: Titus G. LeClair, past-president of AIEE; A. A. Potter, the 1943 recipient of the Award; and L. K. Sillcox, national president of ASME.

Below: Dr. Gustav Egloff (on left), the 1953 recipient of the Award; and E. Montford Fucik, president of the Illinois section of ASCE.

"There are men and women who express the age and the essence of the time in which they live, but who, by the intensity of their imagination and the courage of their convictions and the sweep of their knowledge, and their astounding versatility, rise high above their era and their neighbors, so that they inhabit both present and future at once. When we analyze their minds we can identify nearly all the component elements and yet the compound is far more than the sum of all the elements we choose: richer, intenser, different in quality as a diamond is different from carbon.

"Such a person, is the one we are honoring tonight, in the great good and competent Dr. Lillian Moller Gilbreth, holder of more honorary degrees and honorary memberships in engineering and management societies than all but a very few engineers, named "Woman of the Year" in 1948 and awarded the 1949 Gold Medal for distinguished service to humanity by the National Institute of Social Sciences, and in 1944, recipient of the Gantt Medal jointly with the revered husband, Frank Bunker Gilbreth, whose engineering practice and pioneering contributions to the productivity of the skilled and the physically handicapped alike she took up when he died in 1924.

"One of the few but priceless rewards of the unselfish life as a teacher and practitioner that she has enjoyed has no doubt been that of seeing, not once but again and again, how one student or colleague indistinguishable from the others in an average group, has, by being stimulated by a single remark of a gifted and learned teacher or excited by exploring a new subject, suddenly begun to change. The student grows in wisdom, throwing out original ideas, thus bringing in a new time-scale and maturing blessedly. Somehow, some happy chance or providential effort has — what can we say? There are no images to describe the event, which is as mysterious as all vital processes— something has caused the energies of the student's mind, hitherto dissonant or unused, to combine into a new, living, active, creative synthesis. Such students astonish their friends and parents: usually not themselves, for they feel they are simply learning to use powers which are already their own; and never the teacher, who knows the almost limitless treasure of ability and creativity that every student carries about in the locked safe of his or her mind, and who always hopes and strives to unlock it.

"Sometimes, from high up, one looks down into a barren canyon, whose stony walls echo with the dull roar of the torrent below and with the crash of crumbling slabs and pinnacles above: there is not a patch of green, not a visible handful of nourishing earth; but halfway down those precipitous walls, raising its gallant head and spreading its hopeful arms, there grows a pine tree rooted in an invisible notch, and the birds nest in and flicker from its protective influence. No less delightful and wonderful is it to realize the lovely combination of the work of the dedicated and gifted teacher and the resultant student made willingly ready to serve gladly in behalf of a better world."

At the conclusion of his remarks, Mr. Sillcox introduced Charles E. DeLeuw, WSE president, who presented the Award. After Dr. Gilbreth accepted the award and gave her talk, the chairman closed the meeting.

IIT to Play Host At Education Meet

Illinois Institute of Technology in Chicago will be host May 7 to more than 40 representatives of the 19 liberal arts colleges participating in a combined educational program with Illinois Tech.

Principal speaker will be Arthur V. Wilker, trustee of the Union Carbide and Carbon Education foundation, who will address a 12:30 p.m. luncheon on "Opportunities Presented by the Combined Educational Programs." Wilker is a trustee of Baldwin-Wallace college, Berea, Ohio, one of the participants in the combined program.

The combined program, sometimes called the "3-2 plan," enables a student to receive two degrees in five years of study. He spends his first three years at one of the liberal arts colleges and the last two studying in one of the engineering fields at Illinois Tech.

After the fifth year, the student receives a bachelor of arts or science degree from the liberal arts college and an engineering degree from Illinois Tech.

Two Local Firms Get Burma Contracts

Two Chicago Area firms, Howard T. Fisher & Associates, Inc., and Robert E. Hattis—Consulting Engineers, were awarded a contract on March 21 by the Government of the Union of Burma for the preliminary engineering of a pulp and paper industry development to be constructed near Akyab in northern Burma.

A survey team composed of John A. Pruyn, Harold K. Murdock, Henry R. Miller, and John A. Soissa, has just left for Rangoon to make a field survey.

This paper and pulp industry is the first in a series of projects in the Burmese government's new diversified industrialization program, which will also include construction of plants for the manufacture of steel products, jute and textile bags. This mill, with a capacity of 100 tons of pulp per day, is unusual for several reasons. Bamboo will be used as the raw material. All of the supporting industries which will supply the necessary chemicals for production (i.e., chemical salts, caustic soda, lime and sulphuric acid) are to be developed at the same time. The project entails planning of the site, including an entire new community for the personnel employed in the pulp and paper program. Finally, all of this industry is to be developed in an area distant from existing transportation, power, industrialization and communications.

The Fisher-Hattis firms with the assistance of Elmendorf Research, Inc., were selected to engineer this project on the basis of western world-wide competition, with actual selection being made by the Paper Factory and Chemical Industries Board of the Government of the Union of Burma. This project, along with the entire industrialization program presently contemplated, is to be financed by the Burmese without outside government aid.

When the contemplated pulp and paper mill industrial development is completed, an area with no roads, communications, and civilization in the modern sense will have been converted, through the use of a product formerly considered just as waste material, into a modern industrialized area.

How New Materials Increased

Man's Building Ability

By Walter C. Voss

It would be impossible to speak of new materials without mentioning old materials. Likewise, it is equally as difficult to separate the consideration of materials from methods of their use. Inasmuch as materials must be processed, the techniques of analysis and synthesis must be understood. This must be based upon scientific knowledge, research and experiment. Economic factors also play an important part. Thus, we find ourselves not only discussing new materials, but the developments leading up to their discovery. These developments depend upon available natural resources, our present knowledge in the fields pertaining to them, the power resources available for their production, their distribution and competitive economic advantages.

The progress which man has made during any period of time in any area of the world has depended to a large extent upon the existence and co-ordinated use of the available knowledge, power, materials and transport, and the economic health of the peoples or civilizations involved. Throughout the ancient and medieval world the development of scientific principles, the adaptations of human, animal and machine power, the development of transportation facilities, the means for the discovery and useful employment of local materials, and the increased opportunity for economic advancement were slow, cumbersome, provincial and poorly integrated.

Thus, the Egyptians, knowing only the wheel and axle and the inclined plane, used the available stone to build pyramids, obelisks and tombs, and their limited supply of bronze and wood to fashion sarcophagi and ornament. They used the materials at hand, the buoyancy of water, and the endless supply of slave labor to fashion their monuments. The Assyrians, less competent technically, and having clay, some wood and natural asphalt, pioneered in brick structures. The Persians, a warlike people who raided their neighbors and who had large supplies of lumber and bronze, augmented their choice materials and available labor by military conquest. None of these ancient countries was afforded the interchange of knowledge materials, or skills, with other nations, so necessary to progress. It was not until the Phoenicians, the sailing merchants of the ancient world, spread the activities of many nations abroad, that the interchange of materials and skills began to stimulate advances in those countries where they put in their ships. Power was still furnished by man and later by beasts of burden, but power as we now know it was non-existent.

This slow advance, although gaining some momentum, continued throughout the history of the medieval world. Rome, by conquest, marshalled the materials, means of transport, techniques and wealth of the then known world. The results of coordinated and combined knowledge were emerging. Scientists began the tedious development of the fundamental natural sciences. The elementary knowledge of water power, heat and steam was available. Craftsmen were given a more preferred status, due mainly to the egotism of rulers who wished glamorous buildings and public works. Atheism and polytheism were followed by the faith of the Hebrews, Christians and other monotheistic faiths. These stimulated self-expression and a desire for edifices expressing creeds and honoring saints.

Still all buildings, aqueducts, bridges and such public works as then were possible were assemblages of stone, mortar, tile and brick. Buildings and monuments were adorned with precious metals, bronzes, and jewels. The trabeated systems of construction of the ancients were supplanted by the arch, vault and dome. Builders experimented in masonry to express the new scientific and technical concepts. The artistic elements of buildings progressed rapidly to meet the demands for sacred ornament, paintings and applied decoration. One could go on step by step through these eras of development, all of which were slow, difficult, and continually subject to frustration because of a lack of technical knowledge and the resultant lack of transport, power and the financial prosperity which these may have provided for more intensive study and development.

One must not underrate the legacy which these more than forty centuries of effort, heartaches and frustration passed on to us at the opening of the nineteenth century. With the concepts, theories and physical laws then in existence, we did not need to start "from scratch" in the use of the components of progress — knowledge, power, materials, transport and economic health. All of these had progressed to an unusually high degree as compared to any of the preceding ages of man's activity. However, something extremely revolutionary had happened in the meantime in the civilized world. Men were free, were afforded education, the right to profit in full from their ingenuity, had a multiplicity of materials, had machines and steam and electric power, and in America, little or no dictatorial restrictions from government.

It has been during the last century that all of these contributing factors were rapidly expanded. The manufacture of steel in quantity was made possible by the invention of the Bessemer process in 1856. The steam engine, developed continuously from Savery's effort in 1698 to the improvements of the steam turbine introduced by de Laval in 1889, multiplied our power potential. Electric power became a highly significant factor with the improvements introduced in the dynamo by Wheatstone, Paccinetti and Gramme from 1845 to 1870. Scientists and en-

Walter C. Voss, head of the Department of Building Engineering and Construction, Massachusetts Institute of Technology, presented this talk before the Symposium on Structures and Construction of the Centennial of Engineering, September 8, 1952. Bound volumes of the collected talks given at the Centennial are available at the Museum of Science and Industry, Chicago.

gineers, with the new tools which these and other inventions made possible, rapidly expanded our scientific horizons and knowledge. The knowledge of chemistry increased at an accelerated pace. Synthetics began to replace natural materials. These, in turn, stimulated further effort to solve newly discovered problems. The experimental urge to use these newly developed techniques stimulated bold architectural concepts. Man's urge for comfort resulted in extensions of our knowledge of heat exchanges and the use of solar energy. Now the tremendous possibilities of nuclear energy presage an era of surprising accomplishment which may override all other concepts of power. Notwithstanding the fact that the last century is only 2 to 3 per cent of the known age of civilized man, the progress during this time exceeds by many times that which man had made in all the time preceding it.

When one reviews the history of clay products, one finds that brick has played the role of one of the most remarkable materials in the building industry, discovered perhaps 12,000 years ago. It is quite likely that the tower of Babel and the walls of Babylon were built of brick. Similarly, glazed burned clay products were used by ancient and medieval builders. It was not until the middle of the 19th century that machinery was introduced. Populations increased, more industries developed and greater freedom was being extended to the people. These all helped to increase the demand for brick and developments followed in quick succession. In the United States we passed rapidly from the old handmade brick to the automatic wire cut and mechanically molded varieties. Then followed the introduction of de-airing, the development of compounded clays to produce colors and surface textures and the production of cored brick and tile. Burning developed from the simple scove waste kilns to the continuous kilns. Many shapes of brick and tile, both common structural and ornamental, were manufactured and have been important factors in architectural varieties of finish and plan arrangement. All of this development has taken place during the past 100 years and the cooperation between architects, engineers and manufacturers has played no small part in the progress made in the manufacture of these materials.

All brick and tilework was laid in a mortar, which varied from ordinary clay mud to the combinations of cement and lime which we use today. Before the actual discovery of portland cement in 1824, mortars were usually prepared by combining lime or volcanic ash with sand and crushed stone particles. Quicklime made by calcining limestone was used since ancient days, but is was not until the introduction of the modern rotary kiln and fuels and the improved methods of hydration, that hydrated lime became the reliable, adaptable material for mortars, plasters, concretes and brick. All of these uses, although reminiscent of early practice, have broadened the scope of activity of designers and builders.

The use of gypsum, which in ancient days was almost entirely for plaster work, has been extended during the past hundred years to serve in many other ways. Besides its continued use for plaster, it forms the base for fireproof partition tile, plaster board, and recently has been produced in such a hardened state that it can be employed by industry for shaping light gauge metal sheets.

Probably the most remarkable addition to the field of cementitious materials came in connection with the invention of portland cement. Employed only in small quantities from 1824 to mid-century, the increased use of portland cement was stimulated by the introduction of the rotary kiln and improved controls. These innovations have resulted in the modern high-early strength cements and in a variety of types for particular uses. The cumulative effect of the industrial revolution increased the demands for the material and research extended the horizons of its use. The invention of the automatic block machine resulted in the extensive use of concrete masonry units. With the demand for lighter walls, various aggregates were developed and today we hear of Haydite, pearlite, slag, vermiculite and others in addition to the first use of cinders. Because of the ease of producing many alternate shapes, these units have become a large factor in the reduction of weight and the cost of our buildings.

Probably the most general use of portland cement has been in cast concrete. In this field the development has been paced by technical advances in engineering design. Realizing the possibilities which concrete techniques afforded, the engineers developed the theory of indeterminate structures and thereby made it possible to provide support for the many unusual structures which are so common in modern design. The knowledge of the design and control of concrete mixes derived by tedious and continued research, added materially to the confidence which the engineer had in this highly adaptable material.

(Continued on Page 15)

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The Design Challenges of

Model Railroading

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By Linn H. Westcott

On the way over from the Merchandise Mart in the cab just before this luncheon, several of us were talking about the engineering profession and on how an engineer really is an economist more than any other one thing. It may be an interest in mechanics of one sort or another that drives a fellow into engineering as a profession, but he often finds himself spending more time figuring dollars and cents than stresses and strains. Well, I hope to show you this morning why this hobby of scale model railroading appeals to many professional men, engineers included.

In building a model railroad, one has to solve a great many problems, but usually they are not economic problems and they certainly are not problems of safety. This gives the inventive genius a lot more leeway in working out model engineering problems. For instance, on a real railroad an electrical circuit for a signal system has to be designed so the signal will either work perfectly or if it fails, so it will tell a train to stop. On a model railroad we're satisfied if the signal works most of the time and no great harm is done if something goes out of kilter once in awhile.

Almost everybody is familiar with the kind of model railroading that you see around the Christmas tree every winter. In our business, we call this "toy trains." Not so many of us are so familiar with the other two kinds of model railroading, but they are the rewarding sides of this hobby for anyone looking for a good adult hobby. One of these is model *building*—the putting together of railroad cars, locomotives and track from parts which you either purchase or fashion for yourself. The other is model *railroading*. This is where the model railroad hobby is unique among almost all indoor avocations. Once you have a railroad built you can operate it more or less like the real railroad and this is something like a game of chess, although the rules are not so stringent.

For instance, suppose you want to run a train from here to Oelwein, Ia., on a real railroad. There's only one track, but here and there along the line are what are known as passing sidings. They are turnouts where one train can get off the main line to let another one go by, in either direction. The railroad company's engineering department has located these passing sidings in as few places as possible in order to save construction and maintenance costs. On the other hand, the operating department of the railroad wants as many sidings as it can have to make it easier to move the trains around each other. The owner of a model railroad is both departments in one and he can put the sidings just wherever he pleases, provided he has a big enough room to build his railroad in.

Well now, it seems simple enough when two trains are coming in opposite directions that somewhere along the line, one of them is going to get out of the way of the other. If the railroad is run by timetable, the timetable tells just where such a "meet" should be made, but let's say one train is running late. Then what? Well, there's a rule book on the real railroad which says that the train running in the superior direction—let's say eastbound is superior on this particular railroad—has the right of way over the other. This means it's up to the train crew of the westbound train to get out of the way at some other siding if the westbound train is running late. But if the eastbound train is the one that is running late, the westbound train has to wait at the siding designated by the schedule, for it has no right to go on until it has made the meet with the superior train. The railroad's dispatcher then telegraphs an "order" to the trains to tell them a new place to meet.

These rules may seem ponderous to you if it's the first time you've heard of them, but like the rules of any game, they become a lot of fun when you begin to apply them to all the myriad combinations that will come up, and this is one of the things that makes model railroading as a hobby quite different from the hobbies which are purely mechanical.

It's probably this combination of a craft plus a game that has made model railroading grow so fast. It got its start right here in Chicago at the Century of Progress World's Fair in 1933. Many of you will recall that there were some beautiful scale model trains in the railroad exhibit building. There was an exhibit by the Illinois Central Railroad where the trains ran high around the walls of the room. Then there was a diorama built by the Pennsylvania Railroad with trains running through summer, winter, fall and spring settings. The trains looked so much more realistic than the toy trains we'd seen up until then that many men turned to the hobby of model railroading. Now there are more than 100,000 adults who take the hobby quite seriously and maybe another 300,000 teenagers and hi-railers. Hi-railers are the fellows who use toy equipment but build their own track so they get a more flexible railroad.

The average scale model railroad hobbyist of today is usually a professional man or a skilled workman. He is 31 years old, has a college education, is married and spends about $96 a year on his hobby. That amounts to $1.85 a week, which is a lot less than a good many other hobbies and sports. This average model railroader is buying his own home and he earns somewhere around $4,000 a year. These figures were made in the late 1940's and prob-

Mr. Westcott presented this talk at the noon luncheon meeting of the Western Society of Engineers on Jan. 20 at the Society's headquarters in Chicago. He is creative vice president, Kalmbach Publishing Company, and editorial director, MODEL RAILROADER magazine and MODEL TRAINS magazine.

ably are a little higher now. Those stories you see in the newspapers of locomotives being worth $10,000 are misleading. Actually the fellows who build these locomotives don't spend very much on the parts, but when you figure in all their time, it makes a model quite a valuable trophy. The average model railroader doesn't build quite such a fancy locomotive because he wants time left over to run trains. He gets his fun out of the game side of the hobby as well as the building side.

Sixty per cent of the fellows have a model railroad already far enough along to be operated. That makes at least 60,000 scale model railroads in operating condition. The average size of these railroads is six by eight feet. Some are built even smaller—on a four by eight foot space, while others are built in a half of a garage. Some model railroaders rent a garage down the street for their car so they can build a model railroad in their own garage.

A typical model railroad is built on a framework about three and a half feet from the floor. Most of the track is on a gentle grade going up or downhill in order to pass under other parts of the track. You see, you can get a lot more railroad in a small space if you make use of several levels. The beginning model railroader usually thinks of building an oval of track, but later on he learns how to get a better looking railroad and a longer run for the trains by letting the track weave up and down. If you take the obvious oval track plan and then squeeze it in the center, you get what we call a dogbone shape. Then if you bend the track around so that one of the end loops of the dogbone laps over the other, you can get quite a bit of railroad into a small space. Before we bend this "dogbone", however, we give it a twist. This little trick makes it such that when trains pass near any part of the railroad a second time, they're going in the opposite direction from the previous trip. This gives more variety in the action and makes the railroad seem longer psychologically.

Our track switches are made much more like the real railroad switches than toy train switches are, and we add electrical coil devices called switch machines so that they can be operated even though they are far from the control panel. The power to run scale model trains is distributed down one rail, through the motor of the engine, and back through the other rail, so there is no need for any third rail or other unrailroadlike device.

We control trains by many methods including a system we call "cab control" in which each engineer pilots his own train over the railroad from his own control panel with completely independent control of the two trains. It sounds like radio control, but is much simpler and less expensive than the radio control.

We build our scenery by many different methods but the most popular is to lay wire screen in an undulating fashion over lightly assembled framework and then we plaster over the screen. A second coat of plaster is colored to represent earth and over this, paint and sawdust are sprinkled to represent grass, dirt and other textures. Rock effects are carved out of the plaster too and some model railroaders go so far as to study anticlines, synclines, faults, and the difference between sedimentary and igneous rocks in order to get a more realistic effect.

Model railroading has actual engineering problems too and every once in awhile, something new and fairly revolutionary develops. I'm going to show you fellows one new development today that is not yet known to most of the people in the hobby, but will be very soon. This is what we call "pulsed power." Actually it's the idea of running model locomotives with half-wave rectified electric power instead of full-wave power. Offhand, you might think this would make no difference.

Look at this locomotive running across this portable track that I brought along. First I'm going to run it with full-wave power. Better yet, let's let this fellow here take the throttle. See if you can start the train easily and gradually. . . . It can't be done, can it? Due to the mechanical and magnetic friction in the motor, the engine will jerk to an appreciable speed and it is almost impossible to run it at anything like a slow crawl. Now I'm going to flip this little switch. This changes the power over to half-wave power. Now try the same thing. . . . You see, it's almost unbelievable how much better a small motor starts on a half-wave power—very slowly and gradually. In fact, we timed some of the engines and found that it can take as much as 11 seconds for a commutator to move just one segment with these small motors. Some engines behave better than others with this kind of power, but they all can be run much more slowly and smoothly than with ordinary power. When we discovered this principle—I understand

(Continued on Page 19)

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Management

(Continued from Page 5)

Perhaps a reiteration of some of the fundamental beliefs of engineering and of management will help:

We believe in the dignity of the human spirit—that every human being is an individual worthy to be considered as such, and with a right to creative activity.

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We believe in team work. We believe in utilizing time and energy as well as money, to produce not only things but to develop men and women.

We look forward to the future as presenting many difficult problems. But problems are challenges, and we believe in accepting challenges. So we go forward into the future, out of the past and the present,—looking for opportunities, but recognizing that they bring responsibilities. And realizing that the opportunity we hope for, look for, prepare for, is an opportunity for service.

The welcome invitation to receive the medal awarded tonight reached me in India. I think I replied to it in England. At any rate, I wrote the talk I give tonight flying from London to Rio with stops at Madrid, Lisbon, Dakar, and Riffi.

I think I need not tell you how proud I am to have been selected to join the group who have previously received your award. All these men have been an inspiration to me, many have been my personal, helpful, valued friends.

An award like yours honors a field of activity rather than a person. I am sure that my colleagues in the management field, here and abroad, will share in my pleasure that you have seen fit to appreciate the management field, and those who work in it.

My children and I have an added pleasure in that their father's work was a part of the pioneer effort in the field of management—and that his name is added to your honor list tonight.

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Building Ability

(Continued from Page 10)

The recent application of prefabrication techniques to concrete has contributed to the economy of construction. Many structures are today erected by using prefabricated beams, slabs, walls and arch bents. The addition of prestressing to this technique is already adding greatly to its practicability. Long span bridges are becoming more common. The basic elements of the frame and its envelope are now being made of smaller prefabricated units and this method will materially change the techniques for the use of concrete. The great adaptability of concrete to a variety of shapes and contours has made architectural concrete popular. The architect can use this feature to eliminate the higher costs which are involved in the use of natural or cast stone.

Stone, like brick, has been used for structures since ancient days. The progressive effects of mechanization in the use of this material have been very marked during the last century. The modern carborundum cutting wheels, the large lathes, and automatic moulders and cutters have greatly reduced the labor cost in fashioning stones. The manufacture of cast-stone when coupled with this mechanization has reduced transport costs. Thus, we have advanced greatly in our ability to build in a variety of colors, finishes and ornamentation.

Wood, too, has been used since antiquity. It, also, was often an available natural resource which man soon adapted to many uses. Through the ages, whenever a new technique, shape, or use seemed desirable, wood was put to the test and in many instances served a new and useful purpose. Here, again, progress was slow until mechanical power and automatic machinery stepped in. Again, we had rapid expansion for a variety of uses. The anticipated possibility that somehow the craftsman could do this or that prompted endless innovations. Although the principle of veneering was used for many centuries, it was primarily a method for the conservation of rare woods and grains. When the method of "peeling" of logs was introduced in the 1880's, the use of veneers took on an entirely new turn. Crossveneering with the use of newly developed plastic adhesives allowed not only dimensional stability control, but shaping at the same time. This advance made itself felt in all of the fittings of the modern buildings such as cases, cabinets, doors, paneling and a multitude of other uses which have contributed so much to the progress which we have experienced during the past 100 years. The impact which plywood in its many forms has had on progress since the beginning of the century has been tremendous. It has introduced a new concept into our use of wood and our methods of construction, has liberated the designer from the old concepts of rectangular joinery and its many difficulties and, at the same time, has brought into use heretofore more or less useless woods and wood qualities of cores, conserving the more desirable species for finished surfaces.

The limitations which earlier adhesives, such as animal glues, imposed, were a challenge to the chemist. By intensive research, coupled with the recent rise in the technology of modern plastics, adhesives which were resistant to moisture, which had promise of long life and which could be compounded synthetically to bond wood to fabric and to metals and metals to metals, prompted the engineer to use them for structural laminates. Thus was born the laminated arch, the laminated preformed truss, the preformed and laminated vault. It became possible to span great distances with shapely structural units which eliminated all mechanical fastenings within themselves. These new adhesives, when used on assemblies of dimension lumber and plywood, have resulted in the present design of "skin-stress" panels which possess unusual strength and stiffness and light weight. This continual desire for lighter weight has become an objective of construction practice regardless of the basic materials used and has done much to absorb the economic impact of increasing labor costs by reducing the quantities of materials used and by making use of the ever expanding development of automatic machinery. The increased standard of living so produced has played no small part in the development which we have only recently seen in construction.

While all these innovations in composite assemblies as laminates were going on, the engineer and wood technologist spurred on by the competition they were experiencing from other basic materials sought to develop more effective mechanical joints for structural elements than the old concept of bolts and screws. This resulted in the development of the timber connector which has relegated the old techniques to the discard by making more effective use of the stress resistance of wood. This necessitated the more effective grading of timber and gave us a much greater knowledge of timber characteristics.

Let us now take a look at the progress which has taken place in the use of metals. While the earliest of these was probably a copper alloy such as bronze, the most important early developments were in the manufacture and use of iron. As the principal ores were oxides and carbonates which yielded readily to smelting with carbon, we find that all varieties were iron-carbon compounds. Prior to 1870, the principal varieties were cast iron and wrought iron. Many of you remember the use of cast iron for columns and beams and are aware of the limitations which the properties of this material placed upon design and shape. In 1856, Henry Bessemer, experimenting to improve the quality of metals for cannons, invented the Bessemer converter which revolutionized the manufacture of iron products and produced steel in its early form. It was not until later, however, that Alexander Holley developed a continuous process producing ingots of steel, which was combined with further mechanization to produce shapes without extensive reheating. When the basic, open-hearth process was developed, it was found possible to roll large structural sections from single ingots without the previous difficulty of "hot short" cracking. Thus came into being the wide flange structural section which we know today and which has made possible the construction of the American "skyscraper" and some of our more important bridges. All of this development was paralleled by like progress in the fabrication of composite members in large shops. Welding replaced riveting for many shop joints and is now replacing riveting at the site. All of these advances involved much trial and error, but the courage and ingenuity of the engineer and scientist were not to be denied. Many of you have seen all of this take place in your lifetime and must

be impressed with the tremendous progress made during the past 50 years.

The "know-how" developed in steel rolling was extended to the manufacture of plates, reinforcing steel, pipes, bolts, wires and the like, and these products have played no small part in our parade of progress. These mechanical accomplishments were further employed in producing sheet metals which, because of the ductile and malleable properties which research had made possible, resulted in the production of metal lath and preformed sheet metal products. With a variety of coatings to protect the metal from corrosion, such as galvanizing, enameling and surface immunization, these sheet products have helped to reduce the weight of our buildings, to provide a larger degree of prefabrication, and to reduce costs.

Aluminum, now almost a by-word to every American, was known to Lavoisier who, unable to smelt it, expressed the belief that alumina could not be reduced by carbon. In 1882 the Cowles brothers heated alumina mixed with other metallic oxides by electricity and produced an impure aluminum. It was not until 1907, however, that it became possible to win the pure metal by reduction of the ore by carbon. In the 1880's Heroult in France, and Hall in America, utilized the electrical power made available by the newly developed dynamo to produce aluminum as we know it today. As soon as this was commercially possible, all of the available techniques of rolling, drawing, extruding, and casting were applied to the new metal with the result that we now have available almost any shape in a multitude of tempers for a multitude of uses.

Similarly, magnesium is the result of only recently developed techniques in metallurgical reduction. The electric furnace method developed just prior to World War II produces the pure metal. It, too, is rolled, extruded, drawn and cast. It has become an important element for lightweight structural shapes.

Glass has played no minor role in this record of accomplishment during the last 100 years. It, too, has been known and used for many purposes from antiquity. America has played a very important role in the development of glassmaking. Its wonderful automatic machinery has made it possible to produce at low cost bottles, jars, electric light bulbs, tubing, rods, window plate, and glass block. Glass is now made in the form of a laminated, non-shattering variety, in the double and triple insulating assemblies and with a variety of face patterns and degrees of transparency and translucency. The quality of glass has been improved so that we now have bullet-proof and non-shattering, relatively elastic glass. It is spun into fibers of amazing tensile strength and is used for heat insulation.

Perhaps one of the most glamorous recent materials has been the plastics. Although celluloids and rubber have been known during recent years, they were only the forerunners of the amazing variety of products we now have. Being entirely synthetic in nature, they are made from elemental molecular compounds which are plentiful in nature. These may come from vegetable bases, from oils, from sea water, or from the air. They lend themselves readily to a myriad of combinations to produce products with widely varying physical and chemical characteristics. Many of them can be made either thermo-plastic or thermo-setting and can be varied from thin, lacquer-like consistenciés to rigid, strong solid shapes. It would be impossible to enumerate the many types here because of insufficient time and space.

The progress made in the technology of plastics has given us miraculous adhesives, protective coverings, impregnating liquids for the manufacture of fabrics resistant to fire, acids, alkalies and possessing many other characteristics to meet particular demands. Combinations of these applications have resulted in cored panels of great strength and light weight. They serve in many products manufactured for insulating purposes. They have been the base for many new paints and finishes. In the transparent form used as silicone lacquers, they produce a coating which when applied to masonry structures allows the masonry to "breathe," yet protects it from the entrance of water. The silicone compounds produce a caulking material which is more effective than many of the older materials so used. In the varieties which are included in the synthetic rubber range, neoprenes and their related offshoots give us valuable extruded shapes for gaskets, expansion joints and fillers, without which the modern glass and metal building exterior would be impossible. Used as an adhesive they become the vehicle for preformed laminates of wood, fabric, glass and metal to serve in the production of panels, counters, furniture and containers. Plastics may be said to be the latest example of progress due to scientific research and which is following the pattern of development so characteristic of the last 100 years.

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The effects of heat and sound on the occupants of our buildings have been the concern of our engineers and research scientists to an increasing degree since the turn of the century. Although man always sought comfort to a greater or lesser degree, it was not until he was aware of the serious impairment of his health that he set about improving the conditions under which he lived. As intelligence grew among the masses, man became more sensitive to irritation. This, coupled with his improved economic status, made him covet the comforts heretofore known to only a few. Such demands made it profitable for manufacturers to risk the introduction of new products and to propose new methods. In such an economic atmosphere, linked with the expanded availability of materials which could lend the characteristics needed and the mechanical devices so necessary to mass production, experimentation in heat and sound insulation flourished.

Thus have come into being many successful combinations of materials to lessen the effects of differential heat variations and to control sound absorption, transmission and reflection. Rock and glass wool, aluminum foil for reflective insulation, development of surface treatments for controlled reflection and emissivity have made it possible to provide comfort in the face of high and low exterior temperatures. This has served to lighten the weights of construction and to reduce the cost of fuel or cooling apparatus and make possible a further saving in cost which might stimulate further building. At the same time, comfort increased man's productivity by providing relief from the enervating and exhaustive effects of toil under difficult atmospheric conditions.

In the field of acoustics, new developments are even now gaining substantial headway. The phenomena of the transfer of energy due to sound are more clearly understood. Methods of combining sound absorbing materials and the arrangements of reflective areas so as to produce destructive interference and to reduce reverberation are producing extremely satisfactory results and materially changing many of our classic methods of construction. One need only to scan the pages of our leading popular professional and home magazines to become aware of the many materials offered.

In the field of air-conditioning, we have moved from the archaic concept of heat exclusion by the use of heavy earthen or masonry walls to the provision for cooling air currents and controlled humidities. Refrigeration, first applied to food preservation, using natural ice and later artificial ice, has moved into refrigeration by applying the principles of cooling due to evaporation of volatile liquids. Available electrical devices have steadily improved and it is now commonplace to expect air-conditioned buildings.

The advance in the structural design applications has kept pace with the new materials and techniques. Foundations previously conceived only as spread units to reduce unit concentration on the soil for low buildings were first provided by piles of wood and later of steel or concrete to afford a bearing for heavier loads. Caissons were constructed to bed rock where the rock was sufficiently close to the surface and were belled out where the compressible soil layer was too deep. The principles of pretest piling were added later. From the old frames of masonry and wood providing bearing walls and piers, we have developed within the last century our present concepts of the steel and concrete frames. Our floor systems ordinarily of wood can now be built of concrete slabs, either solid or ribbed, or trussed steel joists, of all metal decking, and of prestressed concrete unit assemblages, to mention only some of the more usual types. The great development in the field of indeterminate structures has made it possible for us to reduce the amounts of materials necessary and to make our materials work more closely to their capacity. This is possible because our knowledge of the behavior of materials has become more exact as a result of the continual research carried on to control their quality.

All of these developments in design, materials, equipment and concept have been a challenge to the builder and the manufacturer of equipment for the erection of buildings. We have moved from the old horse and plank scaffolds so common at the turn of the century to suspended scaffolds; from the ladder and hod to the hoist, derrick and crane; and from the erection of small units one at a time to composite areas prefabricated at ground level. Concrete previously mixed by hand at the site is now mixed in central plants, transported to the site in mixer trucks, hoisted to level and distributed at floor levels or directly placed from bottom-dump buckets on cranes. The erection of structural steel has led the way in this improvement as the urge to utilize the properties of available steel fabrication grew apace. The most recent technique using the advantages of pre-

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stressed concrete now bids fair to provide the possibility for the assemblage and erection of large wall, floor and partition areas at one time.

It would almost seem that we have reached the peak of development in materials and methods for buildings. If the pattern of accelerated improvement is to be believed, we have seen only the beginning of this development. While it is dangerous to predict matters of this kind, certain possibilities seem sure to present themselves. These lie in the fields of power, plastics, prestressed concrete, heating and air-conditioning, and architectural design.

While the development of conventional power will go on at an accelerated pace, the use of atomic power will create the greatest revolution in our methods and equipment for heating, motive power, and scientific research. The extension of our present horizons in atomic physics will give us the tools to analyze the characteristics of materials more accurately, will suggest simpler methods in the field of production, will simplify our equipment and greatly reduce the use of our critical national resources. The impact of the developments in this highly scientific area will stimulate greater activity in all of the fields which heretofore have grown under the application of more conventional concepts.

It may well be true that in the next 50 years we will see plastics developed to such an extent that all panels, doors, much of our hardware, trim, floor and wall coverings, and many of the applied finishes will be greatly improved and reduced in price. The development in lightweight, cored units made of wood, fabric and metals will be phenomenal. Prestressed concrete is used principally at present for bridges and is plagued by high costs. The use of low cost blocks, assembled at ground level and prestressed to fabricate larger units, will become more and more common for walls, beams and slabs, and short span bridge decks. This may well utilize the tremendous capacity which now exists in the concrete block industry and materially reduce the cost of fire-resistant buildings. To predict the progress in the fields of heating and air-conditioning would be a dubious task. Nevertheless, the present cumbersome assemblage of pipes, fittings, ducts and appurtenances may well be replaced by radiantly heated walls and floors. The exterior walls of our buildings may become massive heating or cooling ducts, with the apparatus concentrated in the basements and roof areas. Hot or cooled air will provide the base heating requirements and afford comfort without the use of extensive pipe lines. Our structural frames will be quite different to allow for vertical ventilating shafts at many points. The excessive weights of concrete fireproofing will be reduced by the use of fire-resistant prefabricated shields, further allowing for ducts. Air-conditioning equipment, instead of being custom built for each building, will be provided by movable units provided with strategically located wall shafts and used only when necessary. The tremendous amortization costs of seasonably useless equipment may well be eliminated. Architectural details and planning will greatly affect the activity of manufacturers who will seek to provide materials and equipment to solve such challenges. The use of movable partitions and design for multiple usage will grow. We are already witnessing the greater use of glass and metal skins. This trend will be accelerated and gradually the new problems presented by this approach will be solved. Additions to the presently available materials will greatly assist in this matter. As architects realize that research, engineering and manufacture can solve many vexing problems, they will be more bold and adventurous in their designs. This will stimulate still further advances.

Exhausted frontiers!! We will have to forgive those who contend that we have reached the saturation point. Our present advantages in scientific knowledge, our broad and determined research program, our great advances in the development of power, our ever-expanding adaptation of present materials and the development of new synthetics, our excellent communications, our speedy transport and our hoped for economic status can have only one effect, namely, continued progress. Unless the retarding forces of world troubles cause unhappy setbacks, and unless progress involves an extension of man's inhumanity to man, our next 100 years of industrial activity will make our present excellent status seem provincial in retrospect.

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Frank E. Richart Award Is Announced

The directors of the American Society for Testing Materials announced on March 26 the establishment of the Frank E. Richart Award which has been made possible through the interest of his family.

An honorary member of the Society, a long-time worker and officer, and chairman of Committee C-9 on Concrete and Congrete Aggregates in which field he was an outstanding authority, Professor Richart was senior vice president of ASTM when he became ill. He died in July, 1951, shortly after attending the annual meeting in Atlantic City.

Considering the nature of his work, it is natural that the award should be given for outstanding technical investigations in the field covered by Committee C-9. The award, consisting of a suitably engrossed certificate and an honorarium, the amount of which will be decided by the Board of Directors, is to be given not oftener than every three years. The committee that will make the selection for the first award includes H. J. Gilkey, MWSE, chairman, L. W. Teller and K. B. Woods.

Model Railroading

(Continued from Page 12)

it's known to industry but wasn't to model railroading previous to this—we had to make a lot of tests and among other things, we wanted to know what the effect of pulsed power was on the heat dissipated in the motors. Well, a little pencil calculation shows that the motors run exactly twice as hot but since there is no advantage in running on pulsed power at higher speeds, we're trying to develop better ways of converting from pulsed power over to full-wave power as the motor speed is increased. I've shown you this just to show you there are challenges in this hobby and that that is why is is so interesting to so many fellows in the professional field.

AIEE and AWS Reveal 1954 Program

The program for the 1954 Conference on Electric Welding under the sponsorship of the American Institute of Electrical Engineers in cooperation with the American Welding Society, has just been announced by chairman of the papers committee, A. U. Welch of General Electric Company, York, Pa. The three day conference will be held at Milwaukee, Wis. on May 19-20-21 and has been arranged by the AIEE Committee on Electric Welding under chairman E. J. Limpel, A. O. Smith Corporation, Milwaukee. Conference headquarters and sessions will be at Hotel Schroeder, Milwaukee's largest and most modern hotel.

This is the fourth conference on electric welding and the first to be held outside Detroit where previous welding conferences were held during 1948, 1950 and 1952. Milwaukee was chosen this year because of the large and varied industrial users and suppliers of arc and resistance welders and controls. Plant tours have been arranged at Square D Company, Cutler-Hammer, Inc., Nash Motors and A. O. Smith Corporation.

This year the conference program is aimed at a broad gage inquiry into techniques and problems of the electric welding field. Featured will be discussions and the free interchange of information with welding experts.

M.I.T. to Give Engine Course

A special summer program in Internal Combustion Engines, emphasizing the analytical approach to performance, development, and design problems, will be given from June 15 through June 25 during the 1954 Summer Session at the Massachusetts Institute of Technology.

Dr. Ernest H. Huntress, Director of the M.I.T. Summer Session, says this special summer program is designed primarily for engineers responsible for designing and developing improved models of Diesel or Otto-Cycle engines and for teachers of these and related subjects. The two-week course will be under the direction of C. Fayette Taylor, professor of automotive engineering at M.I.T. and Director of the Institute's Sloan Laboratories for Aircraft and Automotive Engines.

"Throughout all branches of mechanical engineering," says Professor Taylor, "empirical methods are being replaced by new techniques of analysis, correlation, and carefully planned and controlled experimental procedures. Our purpose in offering the special program during the 1954 Summer Session is to illustrate and discuss the application of such methods in the field of power machinery."

An outline of the two-week program includes four topics:

1. Engine capacity: theory of similitude of fluid processes; analysis of the charging and scavenging processes in two- and four-stroke engines; generalized characteristics of compressors and exhaust turbines; the engine-compressor-turbine combination; free-piston engine performance under unusual conditions.

2. Engine efficiency: idealized fuel-air cycles; the equivalent cycle and its use in predicting engine performance; mixture requirements and carburetion; fuel injection; theory and experiment in combustion and detonation; engine friction, wear, and mechanical efficiency; heat losses and cooling.

3. Engine design: rational approach to design problems, use of the theory of similitude; stresses, stress concentration, and fatigue failure; experimental stress analysis.

4. Laboratory techniques and instrumentation: methods for measuring torque, speed, air and fuel flow, pressures, temperatures, etc.; indicators—their calibration, use, and maintenance; oscillographs and electronic devices; vibration isolation; flame photography; methods of studying combustion and detonation; friction studies; accuracy and reproducibility of engine measurements.

Professor Taylor will be assisted in presenting the program by four members of the M.I.T. staff: A. R. Rogowski, associate professor of Mechanical Engineering; J. C. Livengood, research engineer in the Sloan Laboratories; T. Y. Toong, assistant professor of Mechanical Engineering; and T. P. Rona, assistant professor of Mechanical Engineering. Additional guest lecturers will present special topics and reports.

Further information and application blanks may be obtained from the Summer Session Office, Room 7-103, M.I.T., Cambridge 39.

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WSE Applications

In accordance with the By-Laws of the Western Society of Engineers, the following names of applicants are being submitted to the Admissions committee for examination as to their qualifications for admission to membership into the Society in the various grades, i.e., Student, Associate, Member, Affiliate, etc. All applicants must meet the highest standards of character and professionalism in order to qualify for admissions, and each member of the Society should be alert to his responsibility to assist the Admissions committee in establishing that these standards are met. Any member of the Society, therefore, who has information relative to the qualifications or fitness of any of the applicants listed below, should inform the Secretary's office. The Secretary's office is located at 84 East Randolph Street. The telephone number is RAndolph 6-1736.

172-53 Cesar Arriaga, Civil Engr. I, State of Illinois—Highway Division, 160 N. LaSalle St.

173-53 J. Raymond Meehan, Vice President & General Mgr., Fischbach, Moore & Morrissey, Inc., 1011 N. Orleans St.

174-53 James A. Rudy, Sales Engineer, Automatic Electric Sales Corp., 1033 W. Van Buren St.

175-53 George H. Bernhardt, Electrical Eng. & Estimator, Emerson-Comstock Co., Inc., 130 N. Wells St.

176-53 Frank J. Broucek, Sales Engineer, Russell & Stoll-Walker Bros., 53 W. Jackson Blvd.

177-53 Henry V. Van Valkenburg, (Rein.), District Manager, Anaconda Wire & Cable Co., 20 N. Wacker Dr.

178-53 Wm. F. Maguire, President, William F. Maguire Co., 128 N. Clinton St.

179-53 Richard N. Bergstrom, Structural Engineer, Sargent and Lundy, 140 S. Dearborn St.

180-53 William F. Reynolds, Mechanical Engineer, Dept. of Public Works, Bur. of Engineering, 20 N. Wacker Dr.

181-53 Herman J. Lipkin, Structural Draftsman, Bert Exelrod, 608 S. Dearborn St.

182-53 Benedict Garmisa, Public Educational Director, Chicago Street Traffic Comm., 20 N. Wacker Dr.

183-53 Leo A. Des Autels, P. E. 6 Hwy. Eng. IV, Cook County Highway Dept., 130 N. Wells St.

184-53 George W. Barton, 415 Church St., Evanston, Ill.

185-53 Martin M. Blachman, Traffic Engineer, George W. Barton, 415 Church St., Evanston, Ill.

186-53 Jean M. Keneipp, Traffic Engineer, Associated Consultants, 415 Church St., Evanston, Ill.

187-53 George E. Kloac, Engineering Draftsman, Bureau of Street Traffic, City Hall.

188-53 Adrian H. Koert, Traffic Engineer, Associated Consultants, 415 Church St., Evanston, Ill.

189-53 Charles B. Wilcox, Technical Representative, National Lumber Manufacturers Assn., 176 W. Adams St.

190-53 Lt. Paul O. Gaddis, Plant Engineer, Naval Ordnance Plant, Forest Park, Ill.

191-53 Robert L. Reisinger, Jr., Engineer, Soil Testing Services, Inc., 3521 N. Cicero Ave.

192-53 Harold N. Schneider, Structural Engineer, Consoer, Townsend and Associates, 351 E. Ohio St.

193-53 John J. Clark, Field Application Engineer, ITE Circuit Breaker Co., 105 W. Adams St.

194-53 Kendall E. Gerder, Control Engineer, Allen-Bradley Co., 445 N. LaSalle St.

195-53 Frank E. Fisher, Division Building Supt., Illinois Bell Telephone Co., 212 W. Washington St.

196-53 Taisto T. Westen, Application Engineer, I-T-E Circuit Breaker Co., 105 W. Adams St.

197-53 John R. Conrad, President, S & C Electric Company, 4435 Ravenswood Av.

198-53 Irwin A. Cohen, Engineer-In-Training, Automatic Electric Co., 1033 W. Van Buren St.

199-53 Charles R. Locke, 6414 N. Christiana Av.—attending University of Illinois, Navy Pier.

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John T. Rettaliata Speaks on Education

Science and technology must be made integral parts of education from grammar school up, John T. Rettaliata, MWSE, and president of Illinois Institute of Technology declared on March 20.

Dr. Rettaliata spoke at a meeting of the American Technion society at the Standard club in Chicago on the role of science in education.

"We live in a world of technology," the Illinois Tech president said, "and we should be guilty of gross unrealism if we ignored that fact in any part of our educational programs. If we do not learn to understand our own developments, how can we learn to manage them so that they will serve rather than destroy us?"

Technology is the keystone of this country's economy, Dr. Rettaliata continued, and new products and production processes are continually springing from our vast storehouse of technological know-how.

"But this know-how does not perpetuate itself," he warned, "any more than other worthwhile achievements do. It must be preserved in our educational institutions and there transmitted to the youth of our nation."

The part technology plays in the lives of Americans is too often overlooked in college and university curricula, he said, adding that educational institutions should correct this shortcoming where it exists.

Many Plants Have Full Automation

Although the automatic factory may not yet be here, full automation is a reality in many factory operations.

That was the consensus of a panel of experts in a workshop session held March 4 at Illinois Institute of Technology, Chicago, as part of a Work Study Conference attended by engineers and executives from industry.

Panel members agreed that automation can be made to pay its way, but they added that each situation must be carefully analyzed before investments in automatic equipment are made.

Such analyses, they said, should show where the equipment will amortize itself and where it won't. They explained that a manufacturer ordinarily must take it a small step at a time, automatizing one process and then another.

The experts also agreed that the term "automation" is used differently by different people. For purposes of the workshop session, they defined it as meaning factory operations in which parts are mostly handled without human effort. Human workers do two things—they set up the machines and they maintain them.

As an example, panelist L. J. Bishop of Mechanical Handling Systems, Inc., Detroit, described a machine his company had built and installed for a manufacturer of foam-rubber mattresses. Starting with liquid latex, the machine performs each operation successively and automatically with only 14 operators. It runs 24 hours a day and six days a week, requiring almost no service.

"However," Bishop warned, "you don't build a machine like that overnight. You need a lot of experience, and you have to be sure you build quality into it. Otherwise the customer will loose in maintenance costs what he gains in efficiency."

Another panel member, C. F. Hautau of Hautau Engineering company, Ferndale, Mich., supplied other striking examples of automation that has arrived. He described a manufacturer of coaster brakes faced with going out of business because foreign manufacturers, using cheaper labor, could undersell him. Hautau's organization was called in and was able to reduce costs to a competitive level by making the process more automatic.

"Automation can revive a dying industry," Hautau declared. "In some cases, it is the last resort."

Hautau also described a grinding machine for roller bearings that checks each piece as it is made. If it is imperfect, the machine automatically compensates. It then checks the next piece and compensates again if necessary.

"Continuous part-to-part correction of this sort is feasible in quantity production only with automatic equipment," he said. "It is the answer to the problems of many manufacturers of high-precision parts."

L. F. Hesse, Gisholt Machine company, Madison, Wis., also declared that automation is the answer in many processes. He cautioned, however, that there still are jobs that cannot yet be taken over by automatic machines. "Everything depends on the economics of a particular job," he said.

E. H. Wavering, Motorola, Inc., Chicago, described the radio and television set manufacturers as being considerably behind some other industries in adopting automation techniques.

"This probably is because we handle many different kinds and shapes of materials," he said, "and also because we are primarily assemblers. However, I expect progress to be rapid from now on as we and our suppliers learn more about designing for automatic assembly."

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News and Notes

Early railroad items recently given to the Library by Miss Ella Salmonsen, Chief of the Medical Department, include an 1857 payroll of the Tonica & Petersburg Railroad, an 1866 receipt for "use of side tracks" of the Toledo, Wabash & Western Railway; nine payrolls and receipts (1865, 1866, 1868) of the St. Louis, Jacksonville & Chicago R.R.; five statements of joint passenger earnings, 1867, of the St. L. J. & C. R.R. and the Chicago and Alton R.R.; and two letters, 1866, on stationery of M. K. Jesup & Company, N.Y., on whose letterhead appears the name, John Crerar. The Chicago & Alton R.R. also had Mr. Crerar as one of its directors.

* * *

Crerar Current is the title of a new quarterly being issued by the Library for distribution to Crerar Associates, friends, and other libraries. Important subject collections will be described, the February issue featuring the petroleum field; treasures such as the Fuchs "Herbals" are pictured, and various staff members will be introduced in brief sketches. Special services and projects are told in a review of the 1953 program. Of a generally informational nature, the new journal will help the Library keep in touch with its many acquaintances.

* * *

At some time in their career, most engineers have had occasion to use the *Industrial Arts Index* or the *Reader's Guide to Periodical Literature,* publications which index by subject the contents of technical and general magazines. Few engineers will have known the story behind such keys to published information. These and nearly 20 other major services were published by Halsey W. Wilson, who passed away March 1st. Beginning in 1898 with the *Cumulative Book Index,* Mr. Wilson originated his procedures of cumulative indexing which caused the *Saturday Review* to say: "The name H. W. Wilson is to bibliography what Webster is to dictionaries, Bartlett to quotations." His volumes, used by librarians and research workers throughout the world, include also *Book Review Digest, Agricultural Index, Education Index, Bibliographic Index, Biography Index, Essay and General Literature Index,* and others. The publishing enterprise, with 450 employees, will continue in its Bronx, New York, establishment under Mr. Howard Haycraft.

Iowa U. Offers Management Course

The College of Engineering, State University of Iowa, has announced the fifteenth Management Course to be held June 14 through June 26 in Iowa City.

Since its inception over 1000 representatives of American and foreign business, industrial, and governmental organizations have increased their understanding of the design and application of the major management techniques.

It is described as an intensive course for factory managers, foremen, industrial engineers, methods and time-study analysts, cost accountants, and office executives.

The areas of Production Planning, Job Evaluation, Motion and Time Study, Wage Incentives, Plant Layout, Materials Handling, Quality Control, Supervisory Training, Labor Relations and Legislation, Organization and Policy, and Public Speaking are included.

The regular State University of Iowa teaching staff will be augmented by outstanding men from a variety of industries and other educational institutions.

Communications concerning the course should be sent to J. Wayne Deegan, 118 Engineering Building, State University of Iowa, Iowa City, Iowa.

Dr. T. H. Chilton Stays as EMC Head

It was announced at a recent meeting of the Engineering Manpower Commission of Engineers Joint Council that Dr. T. H. Chilton, Technical Director, Engineering Department, E. I. du Pont de Nemours & Company, Wilmington 98, Delaware, will continue as EMC Chairman during 1954. M. M. Boring, Manager of Technical Personnel Division, General Electric Company, Schenectady, New York, has been designated as Vice Chairman. T. A. Marshall, Jr. will continue as Executive Secretary.

The Scientific Manpower Commission, organized during 1953, recently elected M. T. Carpenter, administrative director, Standard Oil Company of Indiana, president, and Dr. Howard A. Meyerhoff, executive director. John S. Nichols, of Yale University, will be SMC vice president during 1954 and Dael Wolfle, of the National Research Council, will act as secretary-treasurer.

In commenting on the EMC and SMC Programs for 1954, Dr. Chilton stated, "The problems of Engineering and Scientific Manpower in our country, as in many other countries, are grave and complex and the activities of EMC and SMC have correspondingly many facets. A primary aim of both organizations, however, will be to function as catalyzers and to carry on and coordinate activities to the end that the recruitment, training, and utilization of scientists and engineers will be seen as an integrated sequence of responsibilities with which the professional societies, industry, education, government, and the public are all vitally concerned."

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On Training—
Letters from Leaders

In the last issue of Midwest Engineer we published another of about thirty letters received from leaders of Chicago-area firms concerning shortcomings noted in the engineers in their employ. Many of the letters also suggested what the engineers should do to correct their deficiencies.

Significantly, the engineer's technical training is generally considered adequate. In the broad area of Human Relations, however, engineers seem often to be "under achievers," according to the viewpoint of the industrial leaders as reflected in their letters.

We are printing another of these letters in this issue, as we shall do in future issues. Although the letters may be of greatest value to the younger engineers, we hope that all of the engineers who read them will benefit.

Here, then, is the next letter:

Dear Mr. Becker:

I am glad to attempt a reply to your letter of August 31 because I believe that the Western Society of Engineers can do much to help its members both technically and in the broader development that engineers frequently need.

Unfortunately, the engineering profession, like many other professions, is a lonesome one. Much of the work that is done by an engineer is done individually and alone. Except at the top administrative levels of engineering, there is little opportunity during working hours for contact with others who have different problems.

Success in supervisory and executive positions requires a knowledge of the technique of administration, a good social sense, and a good commercial sense. Generally, engineers graduate from college well trained technically and, through engineering societies and their day by day experience, they keep up-to-date in engineering matters. The problem is to equip them as adequately in the other respects.

There has been difficulty with many very good engineers in interesting them in other phases of business. They enjoy solving engineering problems. The problems of commercial success and administration interest them very little. If by its meetings and social gatherings the Western Society of Engineers can arouse interest in activities outside of the engineering profession, it will have made a valuable contribution to those engineers who wish to broaden their assignments.

It would not seem in order for the Western Society to conduct classes for teaching commercial sense and business administration, as there are already such courses available. The Society can have interesting speakers in these lines at its meetings from time to time to point out that the problems of commercial success are also challenging.

Sincerely,

Two M.I.T. Men Receive New Jobs

The appointment of Dean Edward L. Cochrane as vice president for Industrial and Governmental Relations and of Professor C. Richard Soderberg as dean of the School of Engineering at the Massachusetts Institute of Technology was announced March 3 by Dr. James R. Killian, Jr., president of the Institute. The appointments became effective April 1.

In the new post of vice president for Industrial and Governmental Relations, Vice President Cochrane, who has been dean of engineering since 1952, will be concerned with the whole range of the Institute's responsibilities to industry and government. He will serve to coordinate and to give administrative support to the special research and advisory activities at the Institute undertaken for industry and government, both national and local, and he will assist the president in discharging the executive responsibilities for this program. He will be a member of the Institute's Corporation.

Dr. Soderberg, who succeeds Vice President Cochrane as dean of engineering, is widely known in the field of applied mechanics and is internationally recognized as an authority on turbine design. Before coming to the Institute in 1938, Dr. Soderberg was manager of the turbine division of the Westinghouse Electric Corporation. He has been head of the Department of Mechanical Engineering at M.I.T. since 1947.

In announcing the two appointments, President Killian said:

"The Institute's growth and its enlarged responsibilities for public service require a further division and re-definition of administrative responsibility. Creation of this new vice presidency will permit Dr. Julius A. Stratton, who is vice president and provost, to devote his primary attention to the Institute's educational program and will greatly assist me in handling the administrative aspects of the Institute's relations with industry and government.

Instrument Congress Plans Trade Center

A Foreign Trade Center will be set up at the First International Instrument Congress and Exposition in Philadelphia, September 15 to 21 inclusive which is sponsored by the Instrument Society of America. The Foreign Trade Center will be under the direction of Ballagh & Thrall, Export Sales Managers, Philadelphia, Pa.

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These items are from information furnished by the Engineering Societies Personnel Service, Inc., Chicago. This SERVICE, operated on a co-operative, non-profit basis, is sponsored by the Western Society of Engineers and the national societies of Civil, Electrical, Mechanical and Mining and Metallurgical Engineers. Apply to ESPS, Chicago and the key number indicated. Prepared ENGINEERS AVAILABLE advertisements limited to 40 words, with typed resume attached may be submitted to ESPS Chicago by members of Western Society of Engineers at no charge.

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POSITIONS AVAILABLE

C-1716 INSPECTOR OF BLDGS.—CE or Constr. Age: 35 plus. 10 yrs. exp. in field of bldg. work. Knowledge of construction work. Duties: Act as inspector of building. Can use man who is retired and had previous bldg. constr. exp. Salary: $6000 top. Location: Northern Indiana.

C-1718 GRADUATE ELECTRICAL—Duties: general supervisory work in electric and water department of a municipality. Must have exp. in maintenance and construction of electric and water distribution. Salary to $6000. Location; Michigan.

C-1722 SALES—HYDRAULICS—Age: 28-38. 2 plus yrs. exp. in hydraulic work from mechanical phases. Duties: train for sales and application work on mechanical hydraulic equipment to O.E.M.'s. Salary: $450-$550. Employer will negotiate fee. About 40% traveling. Location: Chicago.

C-1707 PROJECT ENGINEER—Age: 30-35. 2 plus yrs. exp. in office equipment, cameras or small appliance design. Knowledge of film strip projectors. Duties: project work developing new visual education equipment such as film strip projectors, cameras, etc. For a manufacturer of cameras. Salary: $65-7000 per yr. Loc: Chicago.

C-1724 CHIEF ENGINEER—Grad. Age to 50. 10 plus yrs. exp. in plant layout metal forming and metal fabrication. Knowledge of die design and welding equipment desired. Must have previous supervisory exp. in engineering department either as assistant or chief engineer. For manufacturer of metal containers. Salary: to $10,000 plus bonus. Location: Chicago.

C-1725 PROMOTIONAL SANITARY ENGR.—DEPT. HEAD CE—Sanitary Age: 35-45. 6 plus yrs. exp. in municipal field in contact work. Knowledge of boiler feedwater make up and equipment for municipal work. Duties: contacting, developing and promotional work to municipal engineers on use, application and sanitary and sewage equipment. For a manufacturer of water treatment. Salary: $10,000 to $11,000 plus percentage. Employer will pay fee. Considerable traveling. Location: New York.

C-1726 SALES TRAINEE — Grad. Engrs. Age: to 28. Duties: Sales trainee will spend 6 weeks in engrg. and constr. depts. learning installation of refractory products used for boiler setting incinerator const. and heat treating furnaces application. After this will spend 3 weeks learning business and sales procedure. For mfgrer of refractories. Salary $85 to start—good opportunity. Location: Chicago.

C-1729 GENERAL SUPT. ME or EE—Age: 35-45. 5 plus yrs. exp. in heavy machining, welding & fabricating of metals. Knowledge of production and modern management. Duties: supervision of 35 foremen in mfg. heavy equipment such as lift trucks, welding, electrical assembly, machining and floor assembly. For a mfgr. of material handling equipment. Salary: $9,000-$12,000 Employer will negotiate fee. Location: Chicago.

C-1732 TIME STUDY ENGINEER—Age: up to 35. Knowledge of punch press operations. Duties: time study, methodsrate setting. Must have exp. in metal stamping field. For a manufacturer of hardware. Salary $95/per week. Loc: Chicago.

If placed in a position as a result of an Engineers Available or Position Available advertisement, applicants agree to pay the established placement fee. These rates are available on request and are sufficient to maintain an effective non-profit personnel service. A weekly bulletin of positions open is available to subscribers. Apply ESPS Chicago.

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835 MW FIELD ENGR. ME 56 Twelve yrs. design, constr. and sale of gas storage systems for industrial and utility service. $8400 Midwest.

836 MW CHIEF ENGR. ME 53 Twenty yrs. administration, plant surveys, product design, and supervision of engrg. staff, tests, and field construction force. $8000 Midwest.

837 MW DRAFTSMAN ME 35 Four yrs. layout, design, drafting, calculations, heating, ventilating and plumbing. $6000 Chicago.

838 MW PROJECT ENGR. ME CE 26 One yr. design and dev. of new products for manufacture in field of hyd. & pneumatics. One yr. sales engr. of steel fab. Fifteen mos. development of rocket. $6000 Chicago

839 MW CONSULT. ENGR. AE 34 Ten yrs. sales engr., mach. design of household appliances and food processing machinery. $9000 Chicago.

840 MW PROJECT ENG. ME 33 Ten yrs. project work covering small mechanisms, cams, lubricating filtration system, radar equipment, electrical equipment, and strength of materials. Some work on anti-corrosion and fluid flow. Chicago $6900.

841 MW CHIEF ENGR. ME 33 Three yrs. project eng. involving any steel mill activity. Six yrs. mach. design, production control, hydraulics, tube mfg., time & motion, and tool and die design. $10,000 U.S.

842 MW FACTORY MANAGER 40 Five yrs. charge of production and operating activities. Five yrs. All phases of industrial engrg. for consultant. $8800 Midwest.

Food Industry Needs Engineers

The food industry, which now is going through an era of revolution in unit operations and processes, offers almost unlimited advantages to technical and professional men, according to an article in Food Engineering, McGraw-Hill publication. At present, there is an urgent demand for several thousand food engineers to serve firms in the "biggest, oldest and most stable industry of them all;" a demand that has created a salary level for recent food engineering graduates that exceeds the average for the engineering professions for which comparable data are available, the magazine reports.

Because food engineering is a new profession, only a handful of people hold degrees in that branch of engineering; even those holding degrees in food technology are relatively few in number. In 1947, for example, the food industry, which does $67 billion annually in retail sales and includes more than 30,000 plants in this country, had a potential of only 250 graduating students who were technically equipped for the industry.

The food engineer combines engineering knowledge with a knowledge of the food sciences; his work might be defined as a combination of mechanical engineering and the biological sciences. The technologist also has a background of practical knowledge, but he concentrates on the scientific rather than the engineering aspects of the work.

Numerous Opportunities

Because the dearth of technical know-how is a crippling brake on the progress of the food industry, the magazine suggests that manufacturers take steps to get information about their field into the high schools in their areas. It is pointed out that there are numerous opportunities for both the food engineer and the food technologist, but it is the engineer who will be better equipped to improve factory operations and to cut costs, achievements most highly regarded by top management.

The need for trained men in the food industry covers nearly every phase of technical work: fundamental and applied research, pilot plant operation, quality control, sanitation, manufacturing operations, equipment design and operation, industrial engineering, and even crop production and meteorology. Moreover, there is opportunity for wide diversification, since the average technical man in a food company is concerned with many different phases of the technical and management operations.

Progressive Industry Outlook

The food industry as a whole is estimated to have spent more than $800 million for capital expenditures in 1947, making it the nation's leader in outlays for new plants and equipment. This is significant to the professional man for a variety of reasons: it is indicative of overall confidence in the future, it shows a progressive industry outlook, and, perhaps most important from the food engineer's point of view, it illustrates the tidal waves of technical progress that are sweeping through the food industry. Today's trends, for example, point to a food plant of the future which will be a highly mechanized operation, almost completely dependent on the creativeness, and the subsequent supervision, of a food engineer.

There are other numberless advantages in food today for the young engineer; non-seasonal operations (especially for the research in regard to production line and other improvements); a highly "depression-proof" industry; a chance to work with a vital and diversified product that offers the engineer prestige as well as an interesting and high-paying job; and an opportunity to locate in the area of his preference.

Chicago to Have Chemical Exposition

Two symposia of outstanding interest to the chemical industry will be extra features of the Eighth National Chemical Exposition to be held in the Chicago Coliseum October 12 to 15, 1954.

One will deal with the packaging, transportation and precautionary labeling of chemicals and will be sponsored by the Manufacturing Chemists' Association.

The second, sponsored by the Chemical Market Research Association, will deal primarily with the special problems of exposition marketing, in which the Exposition itself will be offered as "clinical material" for study by the speakers.

The two symposia will combine with the already announced Industrial and Engineering Chemistry Lecture Series, sponsored by the Editors of Industrial & Engineering Chemistry, to round out a broad-interest technical program which will add value to the Exposition far beyond the ideas, new products and new methods which will be the dominant features of the big market.

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Atom Power Said Needed for Fuel

Only by rapidly developing commercial atomic power, despite high initial costs, can the world replace its fast diminishing fuel resources and avoid a return to a caveman economy, an executive of the Westinghouse Electric Corporation said on March 26.

A. C. Monteith, vice president in charge of engineering for Westinghouse, told delegates attending the annual American Power Conference that there is "no other way to balance the energy books, to close the widening gap between what we have and what we need."

"We have heard much talk about how atomic weapons threaten to propel the human race backward into a new caveman era," Monteith declared. "It is seldom pointed out, however, that accelerating depletion of our conventional energy reserves, combined with almost explosive population growth, contain the self-same threat. We can sink into primitivism through exhaustion of power sources as well as through war."

Using a method of Palmer Putnam, consulting engineer to the Atomic Energy Commission, to point up the world's energy requirements in terms of heat equivalent, Monteith said one billion billion (1,000,000,000,000,000,000,) British Thermal Units may be expressed as one Energy Unit.

"It has been estimated that the world burn-up of energy from the year 1 A.D. to the year 1860 was between six and nine Energy Units," he said. "In the 87 years between 1860 and 1947, the world used four more Energy Units—roughly half the amount it had consumed in the preceding 1860 years.

"The present world consumption is two-tenths of one Unit per year—a 400 per cent increase over the average rate of energy used in the period 1860 to 1947. Since energy consumption has been rapidly accelerating over the past 100 years, it seems reasonable to expect a still further increased rate of use in the future.

"The world will begin to consume one energy unit annually beginning about the year 2000. And the year 2000 isn't as far away as we used to think it was. By 2050 the world may find itself burning something like five to 10 Units (five to 10 billion billion BTU's) per year."

Present Fuels Not Adequate

The Westinghouse executive, whose firm is building the atomic reactor for the nation's first civilian atomic power plant, said existing energy sources, such as coal, petroleum and natural gas, all will be good as fuel sources for some years to come, the rate of depletion depending upon the use made of such sources.

However, he added, "conventional energy sources will not be adequate to supply the yearly consumption predicted. Where, then, is future energy to come from?"

Monteith said that the greatest hope lies with energy from the sun, or from the nucleus of the atom. Solar energy is not an early prospect, he said, but atomic energy is.

Turning to the nation's first peacetime atomic power plant, which will be operated by Duquesne Light Company and produce at least 60,000 kilowatts of electric power, Monteith said:

"The designed gross heat output will be 900,000,000 BTU's per hour. The reactor will produce steam at approximately 600 pounds per square inch."

He said that in the civilian atomic power plant project, engineers are not limited by space, weight, and ruggedness limitations imposed by a naval combat vessel, and thus there are many opportunities to save dollars.

"We can never establish the real cost of the first plant until we build it and find out," Monteith added. "Neither can we reduce this cost until a full-scale plant is an operating reality. The building and operating of a plant this size should yield more realistic technical and economic data than could be obtained from a smaller plant. The nation must learn by building."

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Reviews of Technical Books

Standard Time Data

Handbook of Standard Time Data for Machine Shops, by A. A. Hadden and V. K. Genger, The Ronald Press Company, New York, 1954. 473 pages. $10.00

This is the first appearance of a comprehensive source of standard time data for machine shops. Such data has been available in the past for some machine tools, but this is the first book to include all the basic metal-cutting tools. In addition it contains times for arc welding and assembly.

The purpose of standard time data is to provide predetermined times for doing work. This data is presented in what is known as time "elements." For example, the element "blow chips with air hose" includes picking up the air hose, directing an air blast to the jig or piece, moving the blast about, and laying the air hose aside. The standard time for a drill press operator to perform this work element is given in this handbook as .0009 hours.

Machine shop standard data falls into two main classifications, machining times and manual times. Machining times are calculated mathematically based on a recommended cutting speed. This cutting speed, usually stated in feet per minute, depends upon the amount and type of metal removed, tolerance to be held, finish required, machine used, and the nature of the cutting tool. For optimum tool life these factors dictate the proper cutting speed.

Manual times include the work elements of handling materials in and out of machines, positioning, securing, cleaning and gauging the work, and starting and stopping the machine. These times are not calculated mathematically, but are the cumulative results of many stop watch time studies.

It is the intent of this handbook to present standard time data for all machining and manual work elements included in the performance of direct labor operations in a machine shop. Such data can be of considerable value to industry for purposes of cost estimating, work scheduling, and setting production standards which may be used as a basis for incentive wage payments.

Before accepting and using such data unreservedly, especially in connection with an incentive system, the user should be aware of the somewhat less than scientific manner in which it is established. Standard data for manual operations derives from time study. Inherent in time study is the dominant factor of judgment. The time study observer must judge the level of skill and effort of the operator performing the work. On the basis of this judgment he then adjusts the observed time to what he considers a normal time. This normal time, plus allowances, becomes the standard time from which the data of this handbook are gathered. The user of these data has no way of knowing at what level of skill and effort these values are set.

All things considered, the authors have produced a well organized, comprehensive, and valuable handbook of standard time data. For purposes of cost estimating, work scheduling, etc. it is undoubtedly adequate. But the user might well be cautious of setting production standards from it to be used as a basis of incentive wage payments. Such use is not recommended without a verification of the data under the operating conditions of the user's shop.

M.D.K.

Indeterminate Structures

Statically Indeterminate Structures, by Paul Anderson, Ronald Press Company, New York, 1953. 318 pages. $7.50.

Dr. Andersen has written a good textbook for a first or elementary course in indeterminate structures. This was the author's purpose, as stated in the preface. Coverage includes basic principles of structural analysis: deflection theory applied to beams, frames and trusses: general methods and least work solutions: slope deflection and moment distribution. Special topics treated include gable, single, and multistory frames, settlement and temperature effects, haunched beam members, wind stress analyses and space frames. Omitted are discussions of secondary stresses in trusses, studies of arches and continuous bridges, and some of the well-known methods of analysis.

The author's treatment emphasizes not only analysis but also *design* of indeterminate structures which, after all, is the prime purpose of analysis. The book is unique in this respect when compared with modern texts on this subject. What the author calls the methods of "consistent deflections" has been called by previous authors the "general method of indeterminate structures."

The chapter on "space frames" is of particular interest and the material contained in it is valuable. The chapter title was apparently not intended to imply a complete treatment of space frames because 3-dimensional trussed structures are not discussed. The discussion given pertains to torsional effects in rigidly-connected beam frameworks and to members curved in plan and subjected to vertical loads, a type of structure commonly referred to elsewhere as the "bow girder."

Fifty-eight pages of the text comprise an appendix in which tables and charts for analysis of haunched members are reprinted from Portland Cement Association literature. While these charts are useful, this space might well have been used for expansion of the material contained in the various chapters, or an additional chapter might have been added.

While the text contains occasional footnote references to other works it is felt that a bibliography of selected references for student reading might well have been provided, since there are many other texts and a large amount of literature on the subject of indeterminate structures.

E.I.F.

Commission on EMC Releases Text of Letter to President

A recent letter to President Eisenhower endorsing the Appley Committee Report on Manpower Resources for National Security was made public March 1 by the Engineering Manpower Commission of Engineers Joint Council. The text of the letter follows:

"Dear Mr. President:

"The recently published report on 'Manpower Resources for National Security' prepared by the Office of Defense Mobilization, Committee on Resources for National Security under the Chairmanship of Mr. Lawrence A. Appley has been reviewed by the Engineering Manpower Commission of Engineers Joint Council. As Chairman of that body, I would like to express to you our conviction that the report is a very significant accomplishment in the difficult task of constructing a reserve manpower policy in keeping with the needs of this age of technology and peril.

"The Engineering Manpower Commission has been concerned, for the past four years, with the relationship of specialized manpower to our over-all manpower reserve structure. We have felt with great conviction the need for a fundamentally fresh approach in government circles to this problem. The Appley Committee report achieves this. We were particularly pleased to see your general agreement with Dr. Arthur S. Flemming's recommendations based on the report and your directive that a program based on them be prepared promptly for the consideration of the National Security Council.

"We feel assured that at long last, under your expert supervision, this problem is started on the road to effective resolution.

Respectfully yours,
(Signed)
T. H. Chilton, Chairman
Engineering Manpower
Commission"

Obituaries

The Western Society of Engineers has recently been notified of the following deaths:

* * *

Gunni Jeppesen, who first joined the Western Society in 1912 and who had been a Life Member since 1942, passed away on January 20, 1954. He had been a structural engineer with the Chicago Bureau of Engineering.

* * *

George W. Bentz, who had been an instrument and concrete inspector for the Chicago & North Western railroad before his retirement in 1946, died January 26, 1954 in Pekin Hospital, Pekin, Illinois. He had been a member of the Western Society since 1928.

* * *

John S. Prell, who joined the Western Society in 1898 and had been a Life Member since 1937, died on January 30, 1954. Mr. Prell, who lived in Santa Maria, California, had been an invalid for some time. Before his retirement he had been interested in civil and mechanical engineering.

* * *

Edwin H. Armstrong, professor of electrical engineering at Columbia University and a Member of the Western Society since 1953, died in New York City on February 1, 1954. Mr. Armstrong, a Washington Award recipient, had been instrumental in the development of FM radio.

* * *

Isaac Van Trump, a Member of the Western Society since 1914 and a Life Member since 1944, died on February 8, 1954 at Illinois Masonic Hospital. He had been the owner of the Van Trump Testing Laboratories. Mr. Van Trump was a consultant in chemical engineering.

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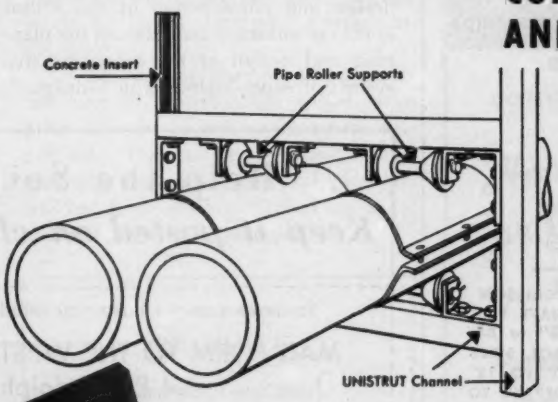

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WSE Personals

Richard Wessling, MWSE, formerly vice-president and director of Electric Supply Corp. of Chicago, Aurora, Hammond, and Milwaukee, has been appointed district manager of the Chicago office of the Allen-Bradley Co., electric control manufacturers of Milwaukee, Wisc. He succeeds John McC. Price, former district manager, who has retired from active service. Wessling graduated from Cornell College, Mt. Vernon, Iowa in 1937 with the degree of B.S. in general science. He did post-graduate work in mathematics at Colorado College, and in electronics at the University of Calif.

Following his basic college training, Wessling spent a year with General Electric Co. in sales engineering training. He later joined Electric Supply Corp. and was advanced to the position of sales manager in 1943. From 1944 to 1946 he served as electrical engineer at the Naval Air Base at Alameda, Calif., returning to Electric Supply Corp. as sales manager in 1946. He became vice-president and a director in 1947.

Wessling is a member of the American Institute of Electrical Engineers, Association of Iron & Steel Engineers, Illuminating Engineering Society, and Electrical Maintenance Engineers Association besides the Western Society of Engineers.

* * *

George L. Jackson, a trustee of WSE, assumed the duties of chief engineer of the Illinois State Toll Highway Commission as of Apr. 1. The Toll Highway Commission was appointed in Oct., 1953, in accordance with an act of the 1953 legislature to study toll highways in Illinois. If routes are found to be feasible, the commission will proceed to construct and operate toll highways. All phases of engineering work in connection with such projects will come under the supervision of Mr. Jackson.

Admiral Francis P. Old, U. S. Navy (Ret), is executive director of the commission.

Following his graduation from Purdue University in 1926 and 12 years with the Sanitary District of Chicago, Jackson was employed by the City Department of Subways and Super-highways from 1938 to 1951. During that period Jackson was connected with the design and construction of the initial system of subways and later on the planning and design of the comprehensive system of super-highways in Chicago.

In 1951 he took the position of expressway engineer for the Chicago Metropolitan Area for the Illinois Division of Highways. That position included the coordination of expressway design and construction of the city, county, and state in Chicago and Cook County as well as the maintenance and operation of complete expressways.

The Chicago office of the Toll Highway Commission is in the State of Illinois Building.

* * *

Lawrence E. Langdon, MWSE, at a meeting of the Board of Directors of the Pacific Flush Tank Co. on Apr. 14 was named vice-president and sales manager of the company. **Clifford B. Cox,** trustee of WSE, was named secretary. **Newton C. Turcot,** Aff. WSE, was named controller. Others named were Harry E. Schlenz, president, and Dorothy N. Burwell, treasurer.

Lester E. Rein, who has been associated with the company since 1901, nine years after its organization, and has served as president since 1934, was elected to the newly constituted office of Chairman of the Board.

* * *

W. W. DeBerard, deputy commissioner in the city water and sewer department, and chief city water engineer, has been voted to receive the George Warren Fuller Award for 1954. The presentation will be made during the week of May 23 by the American Water Works Association.

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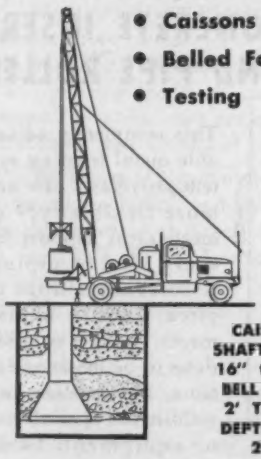

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ASTE Meeting To Feature Exhibit

Many new and interesting pieces of scientific and testing equipment will feature the Eleventh Exhibit of Testing and Scientific Apparatus and Laboratory Supplies to be held at the Hotel Sherman in Chicago, June 13-18, during the 57th Annual Meeting of the American Society for Testing Materials. ASTM registration desks will be placed at both the Sherman and Morrison hotels, where non-members may register for the sessions. Members of the Western Society have been invited to attend. Many of the advantages of this meeting are open to them upon payment of the registration fee.

Leading manufacturers and distributors of instruments and laboratory supplies will emphasize the continued progress being made in providing research and testing engineers with suitable facilities for evaluating the properties of all kinds of materials. There will be new and improved types of equipment covering the determination of the mechanical, physical, electrical, optical and chemical properties of materials of all kinds. Various types of non-destructive testing will be featured.

This exhibit affords all those concerned with research and testing work, whether of a production, control, or research nature, to see concentrated in one place many of the newer developments in the apparatus field.

Adjoining the apparatus exhibit will be the Ninth Photographic Exhibit in which members of ASTM and member companies will display photographs related to the theme: Materials, Testing, and Research. A large number of extremely interesting prints and photomicrographs will be shown.

Anyone interested is cordially invited to attend both apparatus and photographic exhibits.

Pioneers Celebrate

The University of Illinois and Iowa engineering experiment stations, pioneers of research, will jointly celebrate their 50th anniversary in Urbana on June 15. The Golden Anniversary dinner that evening in honor of the two stations will be part of the 62nd Annual Meeting of the American Society for Engineering Education.

John T. Rettaliata Speaks on H-Bomb

One of the nation's leading engineers and educators on April 6 branded as "silly" any proposals to cease experiments to make the hydrogen bomb more effective.

"The H-bomb in the hands of the United States is the greatest instrument for peace that has ever been devised, and our hopes for continued, and possibly permanent, peace will increase in proportion to the effectiveness of the bomb," said Dr. John T. Rettaliata, MWSE, president of Illinois Institute of Technology, Chicago.

Dr. Rettaliata was dinner speaker at a Blast Furnace and Raw Materials conference of the American Institute of Mining and Metallurgical Engineers in the grand ballroom of the Palmer House, Chicago.

"Let us continue our experiments to ever improve the bomb's efficiency and, thereby, our security," he declared. "What would have been our present fate if Russia had the bomb and we did not?

"We must never be second in the race for capability for total annihilation."

The Illinois Tech president and WSE trustee debunked the idea that Chicago would be the No. 1 target for attack by the enemy.

"If Russia ever attempts to attack us one city at a time, she would have great difficulty in ever attacking the second city. Our military reprisal would seriously impair, if not cripple, her striking force if she attacked on a sequential basis," he asserted.

"The only hope for a successful attack by the enemy is to destroy all of our major cities and military bases simultaneously, so that we cannot strike back.

"The entire United States is the No. 1 target."

Dr. Rettaliata emphasized that while the H-bomb is the most destructive force known at the present, biological warfare has a much greater potential for human destruction.

"The nerve gasses and crop and water-supply contaminators can kill much larger segments of the population. But yet, as far as we know, nations do not use these equally horrible weapons against each other.

"Why, therefore," he asked, "should we despair of reaching a similar understanding between nations that the H- and A-bombs will be outlawed?"

"I am confident that by maintaining our scientific and technological superiority we can continue to quarantine all forces of evil and give the world the necessary time slowly to right itself in the years ahead," he concluded.

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IIT Starting Salaries Called Highest Ever

Average starting salaries of January engineering graduates at Illinois Institute of Technology, Chicago, reached an all-time high of $373 per month this year—an increase of $32 over a year ago and $11 more than last June.

The average is based on a survey of mid-year engineering graduates by Earl C. Kubicek, director of alumni relations and placement at Illinois Tech.

The figures are for students receiving a bachelor's degree and planning to work a 40-hour week.

Chemical engineering graduates received the most lucrative starting salaries, with an average of $394, compared to the January, 1953, figure of $327.

Other engineering fields and the average salaries received by mid-year graduates of 1953 and 1954 follow, with the 1954 figures listed first: civil, $388 ($353); mechanical, $370 ($353); electrical, $367 ($345), and industrial, $350 ($356).

The salary average was up 9.3 per cent over a year ago. All the graduates who filed for placement left school with jobs. Each man had an average of 7.5 interviews.

Averages, based on salaries of combined June and mid-year graduating classes, in recent years follow: 1949, $282; 1950, $258; 1951, $295; 1952, $328, and 1953, $362.

Kubicek said the average starting pay for Illinois Tech engineering graduates is above the national average.

"This is because many IIT students have working experience in industry prior to graduation," he explained.

Mr. Charles E. DeLeuw
Midwest Engineer
84 East Randolph Street
Chicago, Illinois

Dear Mr. DeLeuw:

I was very interested to note in the September and October issues of Midwest Engineer the letters in answer to your inquiry on the educational needs of engineers who aspire to become executives. The conclusion reached by your correspondents that liberal education of some kind is required somewhere along the line is the same conclusion many business men are being forced to in connection with non-technical business executives.

One of the solutions I have found to the problem of where this kind of education can be secured on a part-time basis while employed is the Basic Program of Liberal Education for Adults, of the University of Chicago. Your correspondents and readers might be interested in knowing about this four-year integrated adult education course in the liberal arts which offers training in the skills of analytical reading, expression, logic and problem solving. These skills are acquired through study of the works of the great writers of the Western tradition, which give the substance for a deeper understanding of human nature and its problems, the basis for a broader perspective and the background for the cultural and humanistic development of the personality suggested in one of the letters.

I would appreciate your printing this letter in a future issue of Midwest Engineer. You or your readers may secure further details about this Program either from the writer or by contacting Mr. Galway Kinnell, Director, Basic Program of Liberal Education for Adults, University of Chicago, 19 S. LaSalle Street, Chicago, DEarborn 2-7245.

Your very truly,
HYMAN - MICHAELS COMPANY
C. W. Wolf
Vice President

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Index of MIDWEST ENGINEER *Advertisers*

Alden, Vern E. 26
Aldis & Co. 31
Alvord, Burdick & Howson 26
Asbestos & Magnesia Materials Co. .. 20
Battey & Childs 26
Bell Lumber & Pole Co. 21
Berthold Electric Co. 29
Burns, John, Construction Co. 25
Cartland, Silas 27
Case Foundation Co. 30
Commonwealth Edison Co. .. Cover IV
Delta-Star Electric Co. 4
Durkin, J. W. 25
DeLeuw, Cather & Co. 26
Federal Pipe & Supply Co. 10
Flood, Walter, & Co. 26
Gilbert-Hodgman, Inc. 18
Greeley & Hansen 26
Griffenhagen & Associates 26
Gritschke, E. R. 26
Haines Company 16
Hunt, Robert W. 26
Jamar-Olmen Co. 16
Jenkins, Merchant & Nankivil 26
Knight, Lester B., & Associates 27
Lyman, W. H., Construction Co. 22
Meissner Engineers, Inc. 27
Morrison Construction Co. 14
Muncie Construction Co. 17
Reliable Contracting & Construction Co. 31
Sargent & Lundy 26
Sauerman Brothers 23
Schweitzer, W. W., & Co. 19
Soil Testing Services 26
Stanley Engineering Co. 17
Unistrut Products Co. 29
Valentine Clark Corp. 12
Wallace Tube Co. 14
Zack Company 32

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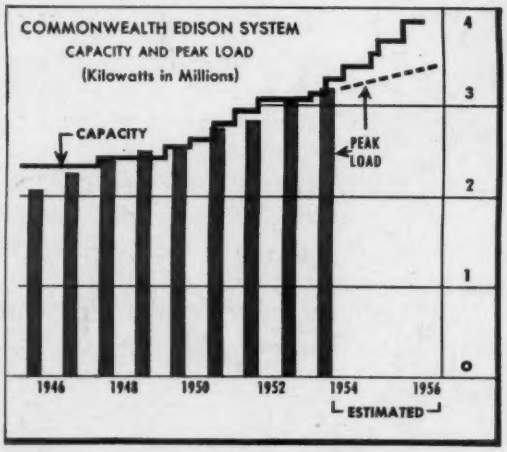

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